Rhodora

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NOTES ON THE FLORA OF NOVA SCOTIA—II

Albert E. Roland

Considerable field work has been done by the author during the last few years, and especially during the summer of 1940 when work was confined almost entirely to the region adjacent to the province of New Brunswick. This is a region characterized by hardwood forests, rich intervales, and an inland flora; and since no botanist has studied this part of the province in any detail since it was visited by Macoun in the early years of this century and before, it seems desirable to indicate any new extensions of range and to confirm some of the old records, especially since the ranges of many of these plants indicated in the more recent manuals do not even approach this territory.

The previous records of the occurrence of the plants in the province are indicated in the following list. If no comment is made, no previous record of the plant being collected in the area is known to the author. Specimens of the plants are in the herbarium of the Nova Scotia Agricultural College, Truro, N. S.

Athyrium thelypteroides (Michx.) Desv. forma acrostichoides (Swartz) Gilbert. Typical *A. thelypteroides* is abundant in rich woods from Kings and Cumberland Counties to Cape Breton, often being the only fern on some of the rich slopes of the Cobequids. Forma *acrostichoides*, or any form approaching it, has been found but once. Kings County: rich ravine, Cape Blomidon.

Dryopteris fragrans (L.) Schott, var. remotiuscula Komarov. Cumberland County: near the falls, about a mile

above the paved road, Moose River; growing abundantly with *Asplenium Trichomanes* and *Woodsia ilvensis.*

This fern is common in northern Cape Breton, but this is the only known station on the mainland, as Rousseau (1) states that apparently it no longer grows at its original station for the province on the Strait of Canso.

Dryopteris Boottii (Tuckerm.) Underw. First found near Halifax and reported by Fernald (2) as common from Yarmouth to Lunenburg County. Colchester County: alluvial thicket, edge of the marsh, Glenholme. Guysborough County: swampy woods, Caledonia Mills.

Lycopodium sabinaefolium Willd., var sitchense (Rupr.) Fern. Reported by Nichols (3) as characteristic of the "grass sedge heath" in northern Cape Breton. It is also common in open pastures throughout the centre of the province. Pictou County: gravelly bank, Salt Springs, *Prince & Atwood*, No. 650; open woods above Trenton. Colchester County: mossy wet pasture above North River. Cumberland County: common in a foxberry pasture above Parrsboro.

Pinus Banksiana Lamb. Now, due to repeated fires and cutting, the dominant pine of Cumberland County. Cumberland County: abundant at Oxford on the sand plains; and common on the poorly drained country north and west of Springhill. Richmond County: common around Louisdale, the first record for Cape Breton.

Outside of a few scattered trees, which may be introduced, this tree has never been found on the pine barrens of Kings and Annapolis Counties.

Typha angustifolia L. Cumberland County: in several small scattered areas around a small lake near the head of tide, south of Amherst, growing with but much less abundant than *T. latifolia.*

Macoun lists it from Windsor; and in Lindsay's list (4) it is credited to Beaver Bank, near Halifax. Recent manuals, however, place the northern limit about Massachusetts or southern Maine.

Zizania aquatica L., var. angustifolia Hitchc. Kings County: one well developed clump in the Canard River, Lower Canard, now destroyed by road construction.

An extension of range southward from New Brunswick.

Milium effusum L. Kings County: common on the top of Cape Blomidon.

Another plant previously reported only from the richest localities between Hants County and Cape Breton.

Oryzopsis canadensis (Poir.) Torr. Previously found by Fernald at Springhill Junction; now found to be common on dry or sterile soil in the northern part of the province. Cumberland County: common with *O. asperifolia* Michx. on the sandy plains at Oxford. Colchester County: *Rhodora-Vaccinium* barren, Masstown.

Muhlenbergia uniflora (Muhl.) Fern. Previously found from Yarmouth to Halifax County, but to be expected in any part of the province. Colchester County: common in a bog near Truro. Cumberland County: common in a grassy meadow near Atkinson Siding. Victoria County: bog near Ingonish in northern Cape Breton.

Glyceria melicaria (Michx.) F. T. Hubbard. Very common and often the dominant grass in wet thickets and shady brooksides from Blomidon, Kings County, northward through Cumberland and Colchester Counties.

Glyceria fluitans (L.) R. Br. Colchester Co.: scattered in swales about Truro.

I have seen no records of this grass from the province, although *G. borealis*, on the other hand, is common throughout.

Spirodela polyrhiza (L.) Schleid. Common in slow-flowing streams of Kings and Cumberland Counties.

Allium tricoccum Ait. Kings County: common on the top of Cape Blomidon. Colchester County: rich hardwoods along the river at Kemptown.

Both localities are in rich deciduous woods in calcareous soil.

Populus tremuloides Michx., var. intermedia Victorin. Seen only once during the summer. Colchester County: damp, low woods at Bible Hill.

Polygonum arifolium L. var. lentiforme Fern. & Griscom. Common in rich thickets through the center of the province. The range is given from P. E. I. southward. Kings County: alder thicket by the Cornwallis River west of Kentville. Cumberland County: thicket by Patterson Lake, above Parrsboro; thicket near River Hebert; wet alder swamp, Economy, *Prince* No. 743.

Nuphar microphyllum (Pers.) Fern. Reported by Nichols as characteristic of ox-bow ponds in northern Cape Breton. It is also found in the few scattered lakes and ponds in Cumberland County: sinkhole in gypsum, Oxford; ox-bow ponds in the meadows above River Hebert.

Actaea rubra (Ait.) Willd., forma neglecta (Gillman)

Robinson. Common in Colchester County: edge of an intervale along Pleasant Valley.

Caulophyllum thalictroides (L.) Michx. Colchester County: one clump in rich deciduous woods along the river intervale, Kemptown.

In this narrow strip of sugar maples between the plowed fields and the river just below the paved road can be found most of the plants which are typical of the richest woodlands in the province, but which are very rarely or never seen to the south and west.

Draba arabisans Michx. Kings County: open coniferous woods on the slope of Cape Blomidon.

Previously known in the Maritimes only from Northern New Brunswick.

Tiarella cordifolia L. Listed by Lindsay from Pictou and Truro. This characteristic intervale plant of Colchester and Pictou Counties is found, together with *Trillium cernuum* and *Uvularia sessilifolia*, on most of the rich wooded hillsides or along the edges of the meadows.

Prunus serotina Ehrh. Groh (5) reports it only from Hants to Yarmouth County. This summer's field work has shown it to be not rare throughout the center of the province where large trees are often seen growing on the deep silty soils. Hants County: edge of a rich intervale, Shubenacadie. Colchester County: river bank at Gay's River. Cumberland County: many large trees along the sandy intervale roadside, Wentworth; roadside thicket, Atkinson Siding; brookside thicket, Springhill Junction.

Desmodium acuminatum (Michx.) DC. Kings County: a large area in deciduous woods along the Gaspereau River about two miles above White Rock.

The first record for the Maritimes.

Desmodium canadense (L.) DC. Long known from the intervales of Colchester and Pictou Counties. C. B. Robinson in 1902 (6) states that along "each of the three Pictou rivers may be seen the leaves of *Meibomia Canadensis* (L.) Kuntze, the flowers not appearing before the middle of July." Colchester County: Salmon River bank, east of the College Farm, Truro. *H. W. Smith*, Aug. 16, 1905.

Vicia tetrasperma (L.) Moench. Becoming a troublesome weed in the light soils of Kings and Annapolis Counties, and common around the edge of the marshes in Colchester and Cumberland.

Vicia hirsuta (L.) S. F. Gray. The range given in Britton & Brown is N. S. southw. but it is very rare in the province. Seen

but once during the summer: edge of the marshland at Glenholme, COLCHESTER COUNTY.

RADIOLA LINOIDES Roth. This tiny flax was long known in North America only from a single collection made at Louisburg, Cape Breton Island, by John Macoun. Recently A. E. Porsild (7) reported it from four additional places, all in Halifax County. It is by now, however, scattered along the whole Atlantic Coast of the Province.

At West Lawrencetown, HALIFAX COUNTY, it grows as thickly as grass and several cm. high over any exposed soil along the roadsides and in moist pastures close to the ocean. RICHMOND COUNTY: wet ground near Arichat, *Roland*, 40,524. SHELBURNE COUNTY: roadside, Round Bay, *Prince & Atwood*, No. 1300.

POLYGALA SANGUINEA L. CUMBERLAND COUNTY: common in a silty acid ill-drained field, Truemanville.

Several species of Polygala in the manuals have been given ranges extending northeastward to Nova Scotia; but they are rather rare and during several seasons of botanizing this has been the only collection made.

COREMA CONRADII Torr. COLCHESTER COUNTY: common in a Jack Pine barren on the site of the military training camp at Debert. CUMBERLAND COUNTY: very common on the sandy pine barrens around Oxford.

Known to be common from Halifax westward, and reported by Rousseau from Guysborough County, it is to be expected anywhere on the peninsula where the soil is thin or sandy.

RHAMNUS ALNIFOLIA L'Her. HALIFAX COUNTY: open pasture, Carroll's Corner. COLCHESTER COUNTY: along meadow thickets west of Brookfield; plentiful over more than an acre of alluvial soil, East Earltown. Reported by Nichols as characteristic of poorly drained swamps in northern Cape Breton; and by Fernald from swampy woods, Springhill Junction.

This shrub is scattered on alluvial or calcareous soil through the central part of the province, and in every locality it was heavily attacked by *Puccinia coronata*.

RHAMNUS FRANGULA L. An occasional escape around Truro and Wolfville; and abundant along roadsides near Amherst, Cumberland County.

ABUTILON THEOPHRASTI Medic. KINGS COUNTY: an occasional weed, garden near Kentville.

MALVA NEGLECTA Wallr.

The small-flowered *Malva* which is common through the Annapolis Valley proves to be this species.

Viola Selkirkii Pursh. Cited in Macoun's Catalogue only from near Windsor, Hants County, and found by Rousseau in woods near Mulgrave, Guysborough County. *V. Selkirkii* is characteristic of the richer woods from Kings County to Cape Breton, although it is not common. Kings County: cool wooded ravine on the slope of Cape Blomidon. Colchester County: rich maple woods, East Earltown; common, Mapleton, *Roland* No. 40,564. Cumberland County: hardwood slope south of Amherst.

Viola eriocarpa Schwein. var. leiocarpa Fern. & Wieg.

Yellow violets are common in rich and especially alluvial soil, or calcareous areas from Kings County to Cape Breton. In Kings County they are mostly confined to the basaltic soils of the North Mountain. Along the intervales of Colchester and Pictou they are exceedingly common and are one of the first violets to bloom in the spring. The ovaries and capsules of the Nova Scotian plants have always been found entirely glabrous.

Lythrum Salicaria L.

This loosestrife seems to be introduced in numerous widely scattered places throughout the whole province. Macoun lists it as abundant in the ruins of Louisburg. Acres of the marshes below Truro are a vivid color when it is in bloom. Fernald reported it from Yarmouth; and it occurs sparingly in a swale behind a small lake at Truemanville, Cumberland County.

Osmorhiza longistylis (Torr.) DC. Reported by Robinson as a much commoner intervale plant in eastern Nova Scotia than usually supposed. It is also found in rich woodland or alluvial soils in Kings County: hardwoods on the top of Cape Blomidon, *Roland* No. 38,133; rocky roadside at Canaan, above Kentville; deep hardwoods south of Coldbrook.

The only collection seen from the northern counties seems to be the following:

O. longistylis var. brachycoma Blake. Stem with dense short spreading hairs. Cumberland County: rich alluvial roadside, Southampton, *Roland* No. 40,587.

Heracleum Sphondylium L. Very common weed in waste places and on roadsides, Truro.

Primula mistassinica Michx. Colchester County: covering a mossy bank along the Salmon River, Valley, *Roland* No.

40,618. Victoria County: mossy area on gypsum cliff, Cape North.

This tiny primrose, which has been reported from several places from northern Cape Breton to Colchester County is certainly one of the rarest of our plants.

Lysimachia thyrsiflora L. This plant, mentioned in Lindsay's list as occurring at Truro and Pictou, is very common in the Salmon River Valley, Colchester County; and the marshes at Truro are yellow when it is in bloom. It is also found about every lakeside and swale in northern Cumberland County.

Thymus Serpyllum L. This is the predominating plant in several fields at Truemanville, Cumberland County, where Macoun found it forty years ago; and from here it has scattered throughout the whole region around Amherst.

Galium boreale L. var. intermedium DC. Kings County: common along the edge of the woods on the top of Cape Blomidon, *Roland & Eaton* No. 38216.

Galium Mollugo L. Another plant reported by Macoun from Truemanville, which has become a troublesome weed to the farmers in Cumberland County.

Triosteum perfoliatum L. var. aurantiacum (Bicknell) Wiegand.

A typical example of the distribution of many of the intervale-plants in the province. Several plants were found in a rich intervale near Truro during the summer; it was reported by Robinson from near New Glasgow; and it reappears again in northern Cape Breton where it is practically restricted to the intervales, or to rich calcareous soils.

Succisa pratensis Moench.

This introduced plant, mentioned by Macoun as established to some extent in fields about Louisburg, is now abundant along the roadsides and in damp fields outside that town. In early September the railroad banks were a solid blue color in many places.

Lobelia spicata Lam. Kings County: common in the run-out fields and pastures on the top of Cape Blomidon.

The only other known station for the Maritimes is in eastern New Brunswick.

Rudbeckia laciniata L. var. gaspereauensis Fern. (8). This indigenous variety with the undersides of the leaves and the petioles and rhachis long-pubescent, is common in the eastern

part of Kings County, and is found also in Colchester. Kings County: shady roadside gully, common, South Berwick; roadside swamp, Cambridge; roadside swale, Lower Canard. Colchester County: roadside swamp, East Mountain, Prince No. 658.

Galinsoga ciliata (Raf.) Blake. Common weed, Lower Barrington Street, Halifax.

Lapsana communis L. A garden weed, Halifax.

Hypochaeris radicata L. Yarmouth County: a serious weed in fields and lawns about Yarmouth and Arcadia.

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5. Herbert Groh and Harold A. Senn, Prunus in Eastern Canada. Can. Jour. Res. C, **18**: 318–346. 1940.
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8. See Rhodora **24**: 205. 1922.

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NOTES ON JUNIPERUS[1]

C. V. Morton

Recently Mr. V. L. Cory[2] has published a paper in which he describes, as a species, *Juniperus gymnocarpa* (Lemmon) Cory, based on *J. occidentalis* var. *gymnocarpa* Lemmon. He writes, "The characteristic feature of the mature fruit, which marks it as a distinct species, is that the solitary seed, which is large for the cone containing it, is exposed at the tip for as much as one-fourth or more of the length of the seed." He also states that " . . . in fully mature fruit it is obviously distinct from all other described junipers." The form discussed has been known

[1] Published by permission of the Secretary of the Smithsonian Institution.
[2] "Three Junipers of Western Texas." Rhodora **38**: 182–187. 1936.

since the time of Engelmann, and has been considered a form of *J. monosperma*.[1]

However, the phenomenon mentioned is not unknown otherwise, being in fact one of the best known abnormalities in *Juniperus*. It was first reported about 100 years ago by Schnitzlein in his Iconographia (1843), and in the following year a similar form of *J. oblonga* M. v. Bieb. was described by Trautvetter[2] as a distinct genus *Thuiaecarpus*, with the single species *T. juniperinus*. It was soon recognized, however, that the exserted seed was not a generic character, or even a specific or varietal one, but a teratological condition. Accordingly, Trautvetter's plant was called *J. oblonga* var. *monstrosa* Antoine.[3] Later on, Ascherson and Graebner called it *J. communis* lusus *thyiocarpos*.[4]

The same abnormality was reported in *J. flaccida* Schlecht., *J. mexicana* Cham. & Schl., *J. tetragona* Schlecht., *J. isophyllos* C. Koch, and *Sabina Grisebachii* Antoine by Antoine. Schlechtendal[5] reported it in *J. communis* and *J. Sabina*. Parlatore[6] reported it in *J. procera* Hochst. and *J. phoenicea* L. Schröter[7] named a similar form *J. communis* var. *nana* lusus *gymnosperma*.

In 1917 a study of this condition was published by Professor Beck v. Mannagetta,[8] and he listed 16 species in which it had been observed. W. Kötter[9] discussed it in his "Normale and anormale Fruchtbildung bei *Juniperus communis* L." The most recent treatment is by R. Florin,[10] who found it in the Cuban species *J. saxicola* Britt. & Wils. Florin showed that this abnormal condition is caused by parasitic insects, probably of the genus *Eriophyces*. The observations of the author confirm this. All the exserted seeds examined lack an embryo and are filled with a mass of insect detritus. One of the species of insect causing these galls on United States species of juniper is *Erio-*

[1] *J. monosperma* forma *gymnocarpa* Rehd. Journ. Arn. Arb. **7**: 239. 1926.
[2] Plant. Imag. Fl. Ross. Fasc. I–II. 11. *pl. 6*. 1844.
[3] Cupress. Gatt. 24. *pl. 35*. 1857.
[4] Syn. Fl. Mitteleur. **1**: 245. 1897.
[5] Bot. Zeit. **20**: 405. 1862.
[6] In DC. Prodr. **16**, pt. 1. 1868.
[7] Ber. Schweiz. Bot. Ges. **13**: 116. 1907.
[8] Sitzungsber. K. Akad. Wiss. Wien. Math. Naturw. Kl. **126**[1]: 403–419. 1917.
[9] Dissertation, Hamburg, 1931.
[10] Arkiv för Bot. **25A**[3]: 11–13. 1933.

phyces ramosus Hodgk. (Bull. New York State Mus. **200:** 20. 1917.)

There is therefore abundant evidence that *J. gymnocarpa* Cory is not a valid species, but a monstrous form of *J. monosperma*. It has unfortunately been taken up recently by Prof. R. J. Preston[1] and assigned a range from Texas to Colorado, Utah, Nevada, and Arizona.

The nomenclature of the Mexican species of *Juniperus* is rather involved. *Cupressus sabinoides* H.B.K.[2] was briefly described from sterile material, with the suggestion that it might prove to be a species of *Juniperus*. This view was adopted by Sprengel;[3] but in transferring the species to *Juniperus* he changed the name to *Juniperus mexicana* Spreng., a procedure quite justified by the practice of the time, because the name *Juniperus sabinoides* would be considered objectionable, *Sabina* being a synonym of *Juniperus*. However, by the present rules, the name was superfluous when published, and is therefore illegitimate. Later, the name *Juniperus sabinoides* Griseb. was given to an Old World species, so the specific epithet *sabinoides* is not available for the Mexican species. The proper name is, therefore, *J. tetragona* Schlecht.[4] which was used by all authorities until recent times. The usually one-seeded form of central Texas and northern Mexico is a recognizable variety, *J. tetragona* var. *oligosperma* Engelm.

A second species was described independently in 1830 as *J. mexicana* Cham. & Schl., a quite different plant from *J. mexicana* Spreng. and belonging to a different group of species. This was renamed *J. Deppeana* Steud., which is erroneously cited by Standley[5] as a synonym of *J. mexicana* Spreng. The true *J. Deppeana* is the species called *J. pachyphlaea* by Standley, at least in part. Whether *J. pachyphlaea* Torr. can be distinguished from *J. Deppeana* is very doubtful. It does not seem that it can be, but the question must be left in abeyance. The synonymy of these species may be summarized as follows:

Juniperus tetragona Schlecht. Linnaea **12:** 495. 1838.—

[1] Rocky Mountain Trees. 1940.
[2] Nov. Gen. & Sp. **2: 3.** 1817.
[3] Syst. Veg. **3:** 909. 1826.
[4] Linnaea **12:** 495. 1838.
[5] Contr. U. S. Nat. Herb. **23:** 62. 1920.

Cupressus sabinoides H.B.K. Nov. Gen. & Sp. **2:** 3. 1817, non *J. sabinoides* Griseb. 1844. *J. mexicana* Spreng. Syst. Veg. **3:** 909. 1826 (illegitimate).—Range: Hidalgo, Durango, Mexico, Puebla, Chiapas, Guatemala.

JUNIPERUS TETRAGONA var. OLIGOSPERMA Engelm. Trans. St. Louis Acad. **3:** 590. 1877.—*J. occidentalis* var. *conjungens* Engelm. l. c.—Range: Central Texas, Chihuahua, Coahuila, Tamaulipas, San Luis Potosí.

JUNIPERUS DEPPEANA Steud. Nom. ed. 2. **1:** 835. 1840.—*J. mexicana* Cham. & Schl. Linnaea **5:** 77. 1830, non Spreng. 1826. ? *J. pachyphlaea* Torr. U. S. Rep. Expl. Miss. Pacif. **4:** 142. 1857.—Range: Doubtful. The type was from Puebla, where the species is common. The extent of the range to the north depends on whether or not *J. pachyphlaea* may be distinguished as a species.

Juniperus monosperma (Engelm.) Sarg. is called *J. mexicana* var. *monosperma* by Cory, but I believe that it may be distinguished as a species. It is found in the southwestern United States; also in northern Mexico, in Chihuahua, Coahuila, and Zacatecas.

It seems probable that there are only 10 species of *Juniperus* in the United States, namely: *J. californica*, *J. communis*, *J. flaccida*, *J. horizontalis*, *J. tetragona*, *J. monosperma*, *J. occidentalis*, *J. pachyphlaea*, *J. utahensis*, and *J. virginiana*. The following are dubious: *J. megalocarpa* Sudw. (probably a variety of *J. utahensis*), *J. Pinchotii* Sudw., *Sabina silicicola* Small, and *S. multiova* Goodw. I have seen no material of *J. erythrocarpa* Cory, from western Texas.

Up until nearly the end of the nineteenth century *J. virginiana* L. was assigned a transcontinental range. Engelmann mentioned especially its interesting distribution. But in 1897 Sargent[1] segregated the western plants as *J. scopulorum* Sarg. He has been almost universally followed since, plants from west of about the 100th meridian being called *scopulorum* and those east *virginiana*. The only tangible difference given is that the western plants are supposed to mature their fruits in two years, the eastern in one year. Even if true, this difference is not necessarily specific. Moreover, examination of many specimens from the West seems to show that the western plants may also mature fruit in a single season. All needs of taxonomy are met

[1] Gard. & For. **10:** 420. 1897.

by calling the western plant *J. virginiana* var. *scopulorum* (Sarg.) Lemmon, and the interests of phytogeography are furthered thereby. The case is similar to that of *Prunus virginiana*, the western varieties of which have been segregated as distinct species, thereby obscuring to the general botanist their relationship.

U. S. National Museum, Washington, D. C.

A MONOGRAPHIC STUDY OF ARABIS IN WESTERN NORTH AMERICA

Reed C. Rollins

(*Continued from page 325*)

3. A. blepharophylla Hooker & Arnott. Perennial; stems simple, one or few from a simple or closely branching base, pubescent with coarse, branching, appressed trichomes, rather more densely so above, rarely somewhat glabrous, 0.5–2 dm. high; basal leaves rosulate, numerous, obovate to oblanceolate, petiolate, obtuse, entire or dentate, pubescent on surfaces and margins with coarse forked or dendritic trichomes or the surfaces glabrous, 2–8 cm. long, 0.5–2 cm. broad; cauline few, ovate to oblong, entire or dentate, sessile but not auriculate, pubescent or glabrous on the surfaces, 1–2 cm. long, 4–10 mm. broad; pedicels erect, stout, pubescent, 5–10 mm. long; sepals pubescent, oblong, purplish, 6–8 mm. long, 2–3 mm. broad, outer pair saccate, inner pair non-saccate; petals rose-purple, broadly spatulate, usually retuse but sometimes merely truncate or rounded, 12–18 mm. long, 4–7 mm. broad; anthers apiculate; glands well-developed around single stamens, obsolete under paired stamens; siliques erect, glabrous, nerved to middle or above, 2–4 cm. long, 2–2.5 mm. wide; style stout when young, more slender on mature siliques, 1–2 mm. long; seeds orbicular, 1.5–2 mm. broad, narrowly winged, dark brown, uniseriate.—Bot. Beech. Voy. 321 (1840); Hooker in Bot. Mag. **33:** tab. 6087 (1874); Greene, Fl. Francis. 254 (1891); Watson in Gray, Syn. Fl. N. Am. **1:** 161 (1895); Jepson, Man. Fl. Pl. Calif. 428 (1925) and Fl. Calif. **2:** 62, fig. 136 (1936). *Erysimum blepharophyllum* (H. & A.) O. Ktze., Rev. Gen. Pl. pt. 2; 933 (1891).—Western California. Map 2. California: without locality, *Douglas s.n.* (G, isotype); Bodega Bay, Sonoma Co., March, 1902, *Heller & Brown 5178* (G, M, NY, P, US); Point Reyes, Marin Co., Feb., 1928, *Mason 4157* (R); April, 1932, *Ferris 8041* (P, UC); Sausalito, Marin Co., March, 1889, *V. K. Chesnut s.n.* (US); June, 1917, *Walker*

3393 (UC); near San Francisco, April, 1903, *Baker 1881* (G, M, NY, P, UC); April, 1903, *Heller 6591* (G, M, NY, P, UC, US); San Mateo County, April, 1903, *Elmer 4736* (M); Monterey, *Andrews s.n.* (G).

There is some variation in the distribution of the indument on the leaves of this species. The blade-surfaces may be relatively glabrous with the margins supporting a fringe of trichomes, as in the isotype specimen cited above, or the entire leaf may be pubescent. *A. blepharophylla* is a species of lower stature, shorter and more obtuse siliques and thicker styles than its relatives from southern Oregon and the extreme northern portion of California. Its flowers are relatively large and colorful. These traits have been responsible for its having been cultivated as an ornamental, both in Europe and America.

Jepson[1] has raised the question as to whether *A. blepharophylla* occurs on the Monterey Peninsula. A fragmentary specimen in the Gray Herbarium marked "Monterey, *Andrews*" in the handwriting of Asa Gray is the only evidence I have seen of its occurrence there, except published reports which were doubtless based on the same evidence. The identity of the specimen is unquestionable, but the actual location of its collection may be only an approximation as was the data preserved on many of the earlier collections sent to Gray from the West for determination. The locality, Monterey, for *A. blepharophylla* represents a considerable southward extension from recent stations, but it is deemed wise to include it as part of the range of the species, since only negative "evidence" against its occurrence on the peninsula is available. So far as I am aware, no systematic search of the entire area has been made.

4. A. **oregana** nom. nov. Perennial; stems one or few from a simple or closely branched caudex, simple or branched above, coarsely pubescent with a mixture of forked and dendritic trichomes, 3–5 dm. high; basal leaves repand to nearly entire, obovate to oblanceolate, obtuse, abruptly narrowed to a distinct petiole, 4–8 cm. long, 1–2 cm. broad, coarsely pubescent with large forked and smaller dendritic trichomes; cauline leaves oblong to ovate, entire or dentate, pubescent to nearly glabrous, sessile but not auriculate, 2–5 cm. long, 5–20 mm. broad; pedicels ascending to divaricate, pubescent, 1–2 cm. long; sepals oblong, purple, pubescent, 5–7 mm. long, 1.5–2 mm. broad, outer pair

[1] Fl. Calif. **2**: 62 (1936).

saccate, inner pair non-saccate; petals spatulate, purple, rounded at apex, tapering to a narrow claw, 4–6 mm. broad, 10–15 mm. long; glands well developed and nearly surrounding single stamens, obsolete under paired stamens; siliques erect to somewhat divaricate, straight, glabrous, nerved nearly to the tip, 4–5 cm. long, about 2 mm. wide; style less than 2 mm. long; seeds dark brown, oblong, narrowly winged on sides, distal portion of wing elongated.—*A. purpurascens* Howell ex Greene in Pitt. **1**: 161 (1888), not *A. purpurascens* Presl, Fl. Sicula **1**: 50 (1826). *A. purpurascens* Howell, Fl. Northw. Am. **1**: 43 (1897) in part. *A. furcata* Wats., var. *purpurascens* (Howell) Watson in Gray, Syn. Fl. N. Am. **1**: 161 (1895), as to name only; Rollins in Res. Stud. State Coll. Wash. **4**: 18 (1936) in part.—Rogue River drainage of southwestern Oregon; Map 2. Oregon: rocky hillsides, Ashland, April 26, 1887, *Th. Howell s.n.* (ND, type; F, M, NY, UC, US, isotypes), May, 1887, *Henderson 1384* (G); junction of Siskiyou and Cascade Mts., Jackson Co., May, 1898, *Applegate 2272* (US); Roxy Ann, Jackson Co., March, 1925, *Brown 11* (FS); Jackson Canyon, Jackson Co., April, 1925, *Brown 26* (FS); Moore Ranch, Little Butte Creek, May, 1927, *Ingram 2348* (FS).

A study of the type of *A. purpurascens* Howell ex Greene at the University of Notre Dame and a mature fruiting specimen of the same collection at the Field Museum has made it clear that the species is unrelated to *A. furcata*, as was formerly supposed. Watson[1] in reducing "*A. purpurascens*" to a variety of the latter species, cited only a Howell specimen from Eight Dollar Mountain which belongs to *A. aculeolata*, indicating that he misunderstood "*A. purpurascens*" as originally described. His concept of *A. furcata*, var. *purpurascens*, which I followed in 1936,[2] was based upon specimens in the Gray Herbarium which are now referred to both *A. oregana* and *A. aculeolata*. With more and better material for study available, I am now convinced that there are three natural and discrete species belonging to the *blepharophylla*-group in southern Oregon and adjacent California.

5. A. **modesta,** sp. nov. Herba perennis; caulibus ramosis vel rare simplicibus stellato-pubescentibus 2.5–4.5 dm. altis; foliis radicalibus petiolatis obovatis obtusis repandis vel integris stellato-pubescentibus 2–6 cm. longis, 8–16 mm. latis; foliis caulinis sessilibus oblongis vel obovatis non auriculatis pubes-

[1] Gray's Syn. Fl. No. Am. **1**: 161 (1895).
[2] Res. Stud. State Coll. Wash. **4**: 18 (1936).

centibus; pedicellis divaricatis vel erectis pubescentibus 6–12 mm. longis; sepalis oblongis pubescentibus 5–7 mm. longis, 1.5–2 mm. latis; petalis spathulatis purpureis 12–15 mm. longis, 3.5–5.5 mm. latis; siliquis immaturis adscendentibus; stylo 1–2 mm. longo; seminibus ignotis.

Perennial; stems one to few from a simple or closely branched base, simple or usually branched above, 2.5–4.5 dm. high, pubescent throughout with small appressed stellate trichomes; basal leaves petiolate, obovate, obtuse, repand to entire, densely and evenly stellate-pubescent, often purplish beneath, 2–6 cm. long, 8–16 mm. broad; cauline leaves few (2–6), remote, oblong to obovate, obtuse, green, sessile but not auricled or clasping, densely pubescent, shallowly dentate to entire, 1–2.5 cm. long, 6–12 mm. wide; older flowering pedicels divaricate to more ascending, pubescent, 6–12 mm. long, elongating in fruit; sepals oblong, pubescent, 5–7 mm. long, 1.5–2 mm. wide, outer pair saccate, inner pair non-saccate; petals spatulate, tapering to a slender claw, purple to pinkish-purple, 12–15 mm. long, 3.5–5.5 mm. wide; nectar-glands U-shaped, subtending single stamens, obsolete beneath paired stamens; immature siliques glabrous, ascending; style 1–2 mm. long; mature siliques and seeds unknown.—*A. furcata* Wats., var. *purpurascens* sensu Rollins, Res. Stud. State Coll. Wash. **4**: 18 (1936) in part.—Southwestern Oregon and adjacent California: Klamath River, near Horsecreek, Siskiyou Co., March, 1926, *Douthitt 5* (FS). Oregon: Josephine Co.: moist sub-shaded banks of the Rogue River, near Galice, April 18, 1926, *L. F. Henderson 5914* (RM, type; M, isotype); Hellgate, Rogue River, Galice Road, May, 1927, *Gabrielson & Ingram 2247* (FS).

A. modesta is a relative of *A. oregana,* but differs markedly in its pubescence-type. The species has uniform four-parted, small, short-stalked trichomes covering the leaves and stems, whereas the indument of *A. oregana* is made up of large forked or dendritic trichomes of different sizes. In the latter species the basal leaves are somewhat ciliate, because of the large trichomes along their margins, and the lower stems are decidedly hirsute. In *A. modesta* the basal leaves are never ciliate, nor is the stem hirsute. Rather, the stem is covered with appressed stellate hairs. Unfortunately, mature fruiting material of this species has not been available. Immature specimens indicate that the siliques of *A. modesta* possess a style 1–2 mm. long. Ordinarily it would be deemed unwise to describe a new species in *Arabis* without seeing mature fruiting specimens, but in this case the

type of pubescence and its distribution upon the plants is so distinctive that I am confident the species is undescribed.

6. A. McDonaldiana Eastwood. Perennial; stems few to many from a branching caudex, simple, glabrous, 5–20 cm. high, slender; basal leaves rosulate, spatulate, repand to somewhat toothed, glabrous or the few teeth rarely bristle-tipped, 1–2 cm. long, 4–7 mm. broad; cauline leaves small, oblong, remote, entire, sessile, 4–7 mm. long, 2–3 mm. broad; pedicels ascending, glabrous, 8–10 mm. long; sepals oblong, glabrous, 5–6 mm. long, 1.5–2 mm. broad, outer pair saccate, inner pair non-saccate; petals rose-purple, narrowly spatulate, truncate or somewhat rounded at apex, gradually tapering to a narrow claw, 9–11 mm. long, 2.5–3 mm. broad; nectar-glands U-shaped, around single stamens, obsolete beneath paired stamens; immature siliques erect or somewhat divaricate, glabrous, 3–4 cm. long; seeds unknown.—Bull. Torr. Bot. Club **30:** 488 (1903). *A. blepharophylla* H. & A., var. *macdonaldiana* (Eastw.) Jepson, Man. Fl. Pl. Calif. 429 (1925) and Fl. Calif. **2:** 62 (1936).—Map 2. California: Red Mountain, near Bell Spring, Mendocino Co., May 21–28, 1902, *Eastwood s.n.* (G, NY, UC, US, isotypes).

This entity is very closely related to *A. aculeolata* Greene, which has a restricted range in southern Oregon. However, *A. McDonaldiana* differs in being entirely glabrous, of lower stature, and in possessing slender, truncate petals. Though little is known of *A. McDonaldiana,* its inclusion as a variety of *A. blepharophylla* where it was placed by Jepson, l. c., is more open to question than would be its association with *A. aculeolata.* Until further exploration of northwestern California yields more and better material, the limits of specific variation and geographical distribution will remain in doubt. *A. McDonaldiana* has much narrower petals than any of its relatives and is the only completely glabrous member of its immediate group.

7. A. aculeolata Greene. Perennial with a branching caudex which is often invested with old leaf-bases; stems few to several, simple, few-flowered, densely hirsute with large simple or forked trichomes, often nearly glabrous above, 2–3.5 dm. high; basal leaves rosulate, obovate to oblanceolate, obtuse, entire or somewhat repand, densely hirsute or the surfaces rarely less so, 1–4 cm. long, 5–10 mm. broad; cauline sessile, not auriculate, entire to few-toothed, hirsute, remote, 5–15 mm. long, 3–6 mm. broad; pedicels erect or slightly diverging, hirsute, 1–1.5 cm. long; sepals pubescent, purple, 1.5–3 mm. wide, 6–9 mm. long, outer pair saccate, broader than the inner, inner pair non-saccate;

petals purple, spatulate, tapering rather abruptly to a narrow claw, 12–20 mm. long, 5–8 mm. broad; nectar-glands well developed at base of short stamens, obsolete beneath long stamens; siliques glabrous, erect, nerved almost to apex, prominently veined, 3.5–6.5 cm. long, about 2 mm. wide; style slender, 1–2 mm. long; seeds orbicular to somewhat oblong, narrowly winged all around, 1.5–2 mm. broad, dark brown, uniseriate.—Leaflets **2**: 69 (1910). *A. furcata* Wats., var. *purpurascens* Watson in Gray, Syn. Fl. N. Am. **1**: 161 (1895) in part; Rollins in Res. Stud. State Coll. Wash. **4**: 18 (1936) in part. *A. purpurascens* sensu Howell, Fl. Northw. Am. **1**: 43 (1897) in part.—Southwestern Oregon: Josephine co.: Eight Dollar Mt., May, 1884, *Th. Howell 35* (G), June, 1904, *C. V. Piper 6256* (US, type); near Selma, March, 1926, *Henderson 5721* (M, RM), May 1, 1924, *Savage s.n.* (UC), May, 1927, *Gabrielson & Ingram 2230* (FS); near O'Brien, April, 1934, *Thompson 10239* (M, NY, US, UW, W); Waldo, April, 1924, *Eastwood & Howell 1404* (G), June, 1884, *Th. Howell s.n.* (G, NY, O, UC, US, WSC); Rough & Ready Creek, April, 1930, *Applegate 6140* (G), May, 1933, *Tracy 12521* (UC).

A. aculeolata is another singular endemic of the "Klamath Region" of southwestern Oregon. The species is related to *A. furcata* on the one hand and to *A. oregana* on the other. From *A. furcata*, with which it agrees in general habit, *A. aculeolata* differs in having much larger purple instead of white flowers, hirsute instead of glabrous upper stems, pedicels and sepals; also the seeds are winged all around rather than merely on the distal end. Actually, *A. aculeolata* is more closely related to all the purple-flowered species of the group than to *A. furcata*, where it has often been included in var. *purpurascens*.

A. aculeolata is distinguished from *A. oregana*, its nearest relative, by its multicipitally branching caudex, smaller basal leaves, shorter stems, uniformly simple or at most forked pubescence, erect pedicels and prominent style 1–2 mm. long. In *A. oregana*, the caudex is usually simple, but may have one or two close branches; the pubescence is made up of a mixture of large forked trichomes with bulbous bases and smaller dendritically branched ones; the pedicels are divaricate, and the siliques have sessile or nearly sessile stigmas.

8. A. furcata Watson. Perennial; stems one or usually several from a simple or branching caudex, slender, simple, erect or ascending, glabrous to sparsely pubescent near the

base, 1–4 dm. high; basal leaves numerous, obovate to spatulate, tapering to a narrow petiole, glabrous to sparsely hirsute, ciliate with forked or simple trichomes along the margins to rarely glabrous, entire to repand or remotely dentate, 2–5 cm. long, blade 5–20 mm. wide; cauline leaves smaller, sessile, entire or rarely dentate, obovate to oblong-lanceolate, mostly glabrous, 1–2 cm. long; sepals oblong, glabrous, 2–4 mm. long, outer pair saccate, inner pair non-saccate; petals white, spatulate, 5–10 mm. long, 2–4 mm. wide, conspicuously veined; nectar-glands surrounding base of single stamen, poorly developed below paired stamens; pedicels ascending, straight, glabrous, 0.5–1.5 cm. long; siliques erect, straight or nearly so, glabrous, 2–4 cm. long, about 2 mm. wide, valves constricted between the seeds, conspicuously one-nerved from base to apex; style about 1 mm. long; seeds oblong-elliptical to nearly orbicular, winged at the distal end only, 1.5–2 mm. long, uniseriate; funiculus nearly equaling the seeds in length.

8a. Var. **typica.** *A. furcata* Watson in Proc. Am. Acad. **17:** 362 (1882) and in Gray, Syn. Fl. N. Am. **1:** 161 (1895); Howell, Fl. Northw. Am. **1:** 43 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 293 (1906); Piper & Beattie, Fl. Northw. Coast 171 (1915); Rollins in Res. Stud. State Coll. Wash. **4:** 17, fig. 5 (1936); G. N. Jones in Univ. Wash. Pub. Biol. **7:** 91 (1939). *A. Suksdorfii* Howell, Fl. Northw. Am. **1:** 43 (1897).—Washington and Oregon. Map 6. Oregon: bluffs of the Columbia, near mouth of Hood River, May 18, 1882, *J. & T. J. Howell s.n.* (G, type); Mitchell Point, May & June, 1909, *Suksdorf 1368* (G, R, UC, US, WSC); Hood River, June, 1879, *J. Howell s.n.* (G); Mt. Hood, July, 1895, *Langile 67* (US), July, 1926, *English 282* (WSC); Elk Cove, Hood River Co., Aug., 1927, *English 837* (WSC); Olallie Mt., near Mt. Jefferson, July, 1928, *Leach & Leach 1974* (O). Washington: Three Brothers Peak, June, 1934, *Thompson 10743* (T, UW), Aug. 1935, *Thompson 12641* (G); Mt. Stuart region, Chelan Co., Aug., 1930, *Thompson 5797* (G); Mt. Stuart, July, 1898, *Elmer 1223* (US, WSC); Earl Ridge, Wenatchee Mts., July, 1933, *Thompson 9549* (G, T); head of Beverly Creek, Kittitas Co., July, 1932, *Thompson 8718* (G); Owyhigh, Mt. Rainier, Aug., 1919, *Flett 3161* (WSC); King Mt., Aug., 1899, *Suksdorf s.n.* (R); upper Ahtanum River, Yakima Co., Aug., 1892, *Henderson 58* (UW, WSC); Flat Top Mt., June, 1923, *Pearson 371* (WSC); Mt. Adams (Paddo), Aug. 10, 1882, *T. Howell s.n.* (O, type; G, isotype of *A. Suksdorfii*), Oct. 1892, *Suksdorf 2472* (G); Chiquash Mts., Skamania Co., Aug., 1895, *Suksdorf 2431* (G).

8b. Var. olympica (Piper) Rollins. Stems simple, slender, hirsute with branched trichomes; inflorescence subcorymbose;

siliques erect, narrowly linear, 18–24 mm. long.—Res. Stud. State Coll. Wash. **4:** 19 (1936). *A. olympica* Piper in Contrib. U. S. Nat. Herb. **16:** 208 (1913); Piper & Beattie, Fl. Northw. Coast 170 (1915); G. N. Jones in Univ. Wash. Pub. Biol. **5:** 158 (1936).—WASHINGTON: near Humes Glacier, base of Mt., Olympus, Jefferson Co., Aug. 12, 1907, *Flett s.n.* (US, TYPE; WSC, isotype).

The alpine or high mountain phase of *A. furcata* tends to be more nearly glabrous, thicker-leaved, and slightly dwarfed as compared with plants from the type station in the gorge of the Columbia River. However, there is no good evidence that the alpine plants really represent a discrete taxonomic entity. The distinctive characteristics of *A. furcata* run through the entire series, leaving no doubt as to the continuity of form and structure. Without experimental evidence, it is impossible to know whether the superficial differences between the "Columbia Gorge" phase and the high altitude phase from the adjacent Cascade Ranges are constant, but on the basis of their morphology and geographical distribution, it seems most satisfactory to treat them as a single species. Therefore, *A. Suksdorfii* is considered to be an unequivocal synonym of *A. furcata.*

The type of var. *olympica* has been re-examined since my former treatment, op. cit., and the disposition given there seems valid. There is a slight possibility that the specimens upon which var. *olympica* was established will eventually be considered to be a depauperate form of *A. hirsuta.* More material together with accurate field observations in the type region are needed before the disposition of var. *olympica* can become more conclusive.

9. A. NUTTALLII Robinson. Perennial; stems several to numerous from a branching caudex, simple, slender, erect to slightly decumbent at base, glabrous above, hirsute with rather long simple or often forked trichomes below, 6–35 cm. high; basal leaves spatulate-oblanceolate to obovate, obtuse, rosulate, entire, petiolate, ciliate and hirsute on both surfaces to glabrous, thin and membranaceous or sometimes coriaceous, 1–4 cm. long, 4–10 mm. wide; cauline leaves oblong to somewhat elliptical, sessile, not auriculate, hirsute on both surfaces to glabrous, 5–15 mm. long; nectar-gland surrounding base of single stamens, very small or obsolete beneath paired stamens; sepals oblong, sparsely pubescent or glabrous, 2–4 mm. long, outer pair saccate, inner pair non-saccate; petals white, spatulate, 5–8 mm. long, 2–4 mm.

wide; pedicels glabrous, slender, divaricately ascending, 5–20 mm. long; siliques erect to slightly spreading, straight, glabrous, inconspicuously 1-nerved or the nerve obsolete, 1–3 cm. long, 0.8–1.5 mm. wide; style slender, about 1 mm. long; seeds small, less than 1 mm. broad, oblong, wingless, uniseriate; cotyledons accumbent.—In Gray, Syn. Fl. N. Am. **1:** 160 (1895); Howell, Fl. Northw. Am. **1:** 42 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 292 (1906); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 358 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 243 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 12, fig. 4 (1936). *A. spathulata* Nuttall in T. & G., Fl. N. Am. **1:** 81 (1838), not *A. spathulata* DC., Syst. **2:** 227 (1821). *Erysimum Nuttallii* O. Ktze., Rev. Gen. Pl. pt. **2:** 933 (1891). *A. bridgeri* M. E. Jones, Contrib. West. Bot. **14:** 38 (1912). *A. macella* Piper in Proc. Biol. Soc. Wash. **33:** 103 (1920).—Alberta to Wyoming, Nevada? and Washington. Map 6. Without definite locality (probably Wyoming): Platte River, Rocky Mountains, *Nuttall s.n.* (G, isotype). Alberta: Crow Nest Pass, Aug., 1897, *J. Macoun 18162* (G, ND, NY). Montana: Logan Pass, Glacier Co., June, 1934, *Maguire et al. 1503* (R, UAC); Upper Marias Pass, Aug., 1883, *Canby 17* (G); Columbia Falls, June, 1893, *R. S. Williams 167* (RM, US); Helena, Clark Co., May, 1889, *F. D. Kelsey s.n.* (UC); Bridger Mts., June, 1897, *Rydberg & Bessey 4230* (G, NY, RM, US, WSC); Mt. Bridger, Gallatin Co., Aug. 10, 1905, *M. E. Jones s.n.* (P, type of *A. bridgeri*); Red Rock Lake, Madison Co., June, 1899, *A. & E. Nelson 5479* (G, RM, US); Rock Creek Canyon, Carbon Co., July, 1937, *L. O. & R. Williams 3590* (G, R). Wyoming: near Medicine Mt., Big Horn Co., July, 1936, *L. O. & R. Williams 3346* (R); 15 miles east of Kane, June, 1936, *L. O. & R. Williams 3025* (G, M, R); Soda Butte, Yellowstone Nat. Park, July, 1899, *A. & E. Nelson 5833* (RM); 15 miles northeast of Bondurant, Sublette Co., Aug., 1922, *E. B. & L. B. Payson 3024* (G, RM, UC, US); Sheep Mt., near Alpine, Lincoln Co., July, 1923, *Payson & Armstrong 3461* (G, RM); hills east of Afton, June, 1923, *Payson & Armstrong 3273* (G, RM); Evanston, Uinta Co., May, 1897, *A. Nelson 2961* (RM, WSC). Idaho: high mts., Kootenai Co., Aug., 1892, *Sandberg s.n.* (UW, WSC); Wiessners Peak, Kootenai Co., July, 1892, *Sandberg et al. 601* (G, UC, US); divide between St. Joe and Clearwater Rivers, Shoshone Co., July, 1895, *Leiberg 1239* (G, RM, UC, US); Bearskull Mt., July, 1929, *Epling s.n.* (UCLA); Camas Meadows, Clark Co., June, 1938, *Davis 337* (G, R); Henry Lake, Fremont Co., July, 1920, *E. B. & L. B. Payson 1985* (G, RM); near Soda Springs, Caribou Co. (formerly Bannock Co.), June, 1920, *E. B. & L. B. Payson 1722* (G, RM), May, 1939, *Davis 826* (R).

Utah: Cache Co.: Lewiston, May, 1911, *C. P. Smith 2367* (NY, RM); Logan Canyon, *Muenscher & Maguire 2347* (UAC), May, 1909, *C. P. Smith 1572* (RM); 3 miles west of Logan, May, 1932, *Maguire 3452* (G, M, UAC); Mt. Magog, July, 1936, *Maguire et al. 14066* (G, R, UAC). Nevada: Sonoma Range (Havallah Mts.), Humboldt-Pershing Cos., June, 1868, *S. Watson 67* (G). Washington: Columbia River Valley, May, 1911, *Gabby 65* (WSC); Spokane, May, 1899, *Piper 2950* (WSC); Medical Lake, Spokane Co., May, 1893, *Sandberg & Leiberg 50* (Cl, G, O, UC, US, WSC); Crab Creek, Lincoln Co., June, 1884, *Suksdorf 238* (G, WSC); Sprague, Lincoln Co., June, 1893, *Sandberg & Leiberg 202* (G, UC, WSC); near Rock Lake, Whitman Co., May, 1936, *Rollins & Constance 1096* (G, R, WSC); Ritzville, Adams Co., June 11, 1893, *Sandberg & Leiberg 202* (US, type; O, isotype of *A. macella*).

Since my former treatment of this species,[1] a number of new collections have been studied, particularly from Utah where both the high-altitude and lowland phases have been collected in abundance by Dr. Bassett Maguire. It was previously concluded that *A. Nuttallii* showed recognizable tendencies in a lowland phase named *A. macella* by Piper and a sub-alpine phase named *A. bridgeri* by Jones. The lowland phase of *A. Nuttallii* is recognizable because of its taller habit, weak, slender stems and long, slender pedicels. Plants of this phase have been collected in Montana, Idaho, Utah and Washington or at local stations roughly approximating the range of the species.

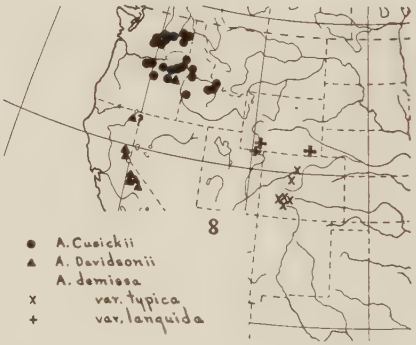
The high-altitude phase of *A. Nuttallii* is nearly or wholly glabrous, the leaves are thickish and the pedicels tend to be reduced. Plants of this phase are apt to be a trifle more robust with a more highly branched caudex than the usual phase of the species. These nearly glabrous plants have been collected at mountain stations in Montana, Idaho, Wyoming and Utah. It has been pointed out elsewhere that many species of *Arabis* which have a rather wide altitudinal occurrence are likely to develop a glabrous phase at high elevations. In some instances, for example in *A. platysperma*, the glabrous condition is accompanied by correlated minor morphological differences and a distinctive geographical range. In such cases, it seems worth while formally to recognize these correlated divergences from the typical pattern by applying a varietal epithet to the plants

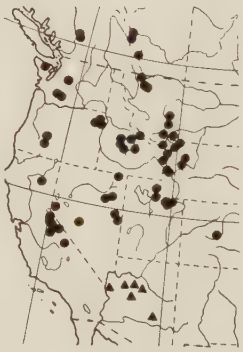
[1] Res. Stud. State Coll. Wash. 4: 14 (1936).


5
A. lyrata var. kamchatica


6
● A. Nuttallii
x A. furcata
▲ A. crucisetosa


7
A. divaricarpa


8
● A. Cusickii
▲ A. Davidsonii
A. demissa
x var. typica
+ var. languida


9
● A. Lemmoni var. typica
▲ A. gracilipes


10
A. repanda
● var. typica
▲ var. Greenei

which fall into this category. On the other hand, if glabrous plants appear here and there throughout the range of a species, probably in response to ecological rather than genetical factors; if these plants do not have significant correlated characters or a distinctive geographical range; and particularly, if there is intergradation with the usual phase of the species, it seems hardly necessary to designate them nomenclaturally. *A. Nuttallii* is a species of the latter type in which a transitional series from a rather lax, pubescent lowland type to a compact, glabrous, high-altitude type might be encountered almost anywhere in its range where the plants are abundant and suitable habitats are to be found.

I have seen a single collection of undoubted *A. Nuttallii* which supposedly came from Nevada. The specimen is Watson's number 67 labeled, "Arabis hirsuta Scop., Havallah Mts. [now known as the Sonoma Range], N. Nevada, June, 1868". The data on this specimen may be perfectly accurate, but one's suspicion is aroused by two items. (1) Watson reported this collection under *Arabis hirsuta* in the Botany of King's Expedition[1] as being from the "Wahsatch and Uinta Mountains, Utah". (2) The station is several hundred miles from the nearest known locality for the species and is outside the expected range. Undoubtedly this collection was the basis for Robinson's inclusion of "N. Nevada" in the range of *A. Nuttallii* in the Synoptical Flora, l. c.

10. A. CRUCISETOSA Constance & Rollins. Perennial; caudex simple or branched; stems several to numerous, rarely single, simple or sometimes branched above, slender, glabrous to sparsely pubescent below, 1–4 dm. high; basal leaves numerous, spatulate to obovate, obtuse, petiolate, entire to sparsely dentate, harshly pubescent with dendritic cross-shaped or three-pronged trichomes, rarely almost glabrous, dark green above, paler to purplish below, 2–6 cm. long, 6–15 mm. wide, petiole nearly equalling the blade in length; cauline leaves few, sessile, not auriculate, entire or rarely few-toothed, linear-oblong, obtuse, 1–3 cm. long, 2–6 mm. wide, pubescent to glabrous on the surfaces, margins always pubescent; sepals oblong, yellowish, rarely purple-tipped, scarious-margined, glabrous, 3–4.5 mm. long, outer pair saccate, inner pair non-saccate; petals lingulate, white, 6–9 mm. long, 2.5–3 mm. wide; pedicels slender, glabrous, di-

[1] King, Geol. Expl. Fortieth Parallel 5: 16 (1871).

varicate, 1–2 cm. long; stamens very unequal, filaments projecting into a small apiculate tip above the anthers; nectar-glands surrounding single stamens, very poorly developed beneath paired stamens; siliques erect, glabrous, straight or nearly so, nerved below, 2–4 cm. long, 1–1.5 mm. wide; style about 1 mm. long; seeds oblong, about 1 mm. broad, wingless, uniseriate.—Proc. Biol. Soc. Wash. **49**: 147 (1936); St. John, Fl. Southeastern Wash. Adj. Idaho 164 (1937).—Western Idaho and adjacent Washington. Map 6. Idaho: Nez Perce Co.: 19 miles east of Spalding, June, 1937, *Constance, Hedrick & Peters 1886* (G, R, WSC); near the Clearwater River, 27 miles east of Lewiston, April, 1936, *Beinke 83* (G); 10 miles east of Lewiston, April, 1930, *Maxfield 46* (G, R). Idaho Co.: between Steep Creek and Willow Creek, Snake River Canyon, May 16, 1936, *Rollins, Constance & Dillon 1107* (WSC, type; G, M, NY, R, isotypes); between Lightning Creek and middle fork of Sheep Creek, May, 1936, *Baubier, Fosberg & Hardt 74* (G, R, WSC); Little Granite Creek, 1 mile above its mouth, May, 1937, *Packard, Moore & Katznelson 207* (G, R). Washington: Lime Point, Asotin Co., April, 1928, *St. John 9294* (R, WSC).

Arabis crucisetosa is nearest related to *A. Nuttallii* which it resembles in general habit and many important morphological features. The foliage, seeds, disposition of siliques, style-length and color and size of flowers are all similar in the two species. However, there is no difficulty in distinguishing between them because of the great difference in type of pubescence. In *A. crucisetosa* the trichomes are dendritic with four (rarely three) prongs raised on a central stalk, but in *A. Nuttallii* the trichomes are very much coarser and simple or at most merely forked. Besides this marked difference, *A. crucisetosa* is a taller species with longer pedicels and siliques and narrower cauline leaves which tend to become dentate. *A. crucisetosa* is rather common in the Transition and Lower Canadian Life-zones on high hills and in the mountains bordering the Snake River drainage in western Idaho and adjacent Washington. The known distribution is limited, but an extension is to be expected at least to the Oregon side of the Snake River.

11. A. lyrata L., var. kamchatica Fischer ex DC. Stems simple or branched, often flexuose, 1–4 dm. high; basal leaves pinnatifid to coarsely dentate or nearly entire, lyrate, spatulate or obovate, petiolate, pubescent with simple or forked trichomes or usually glabrous, 2–6 cm. long; cauline leaves sessile, not auriculate, oblong to broadly spatulate, entire to coarsely dentate,

FIG. 1. A. ACULEOLATA drawn from *T. Howell* s. n. collected in 1884; FIG. 2. A. RIGIDISSIMA drawn from *Tracy 14469* (TYPE); FIG. 3. A. FERNALDIANA drawn from *Rollins & Chambers 2520*. All figures about one-half natural size.

glabrous; petals white to pinkish, 4–8 mm. long; outer sepals saccate, inner non-saccate; siliques erect to divaricately ascending, glabrous, 1–1.5 mm. wide, 1.5–4 cm. long; style very short or absent, rarely up to 1 mm. long; seeds wingless, oblong, uniseriate, about 1 mm. broad, cotyledons accumbent.—*A. lyrata*, var. *kamchatica* Fischer ex DC., Syst. **2:** 231 (1821); Nakai in Tok. Bot. Mag. **32:** 239 (1918); Hultén, Fl. Kamtchatka **2:** 165 (1928); Hopkins in Rhodora **39:** 92 (1937). *A. ambigua*, var. *glabra* DC., l. c. *A. ambigua*, var. *intermedia* DC., l. c. *A. arenosa* sensu Cham. & Schlecht. in Linnaea **1:** 17 (1826). *A. ambigua* sensu Hooker, Fl. Bor.-Am. **1:** 42 (1829). *A. kamchatica* (Fisch.) Ledeb., Fl. Ross. **1:** 121 (1842); Busch in Notul. Syst. Hort. Bot. Petrop. **3:** 11 (1922), Fl. Sib. Orient. Ext. **4:** fam. 25. 466 (1926) and in Komarov, Fl. U.R.S.S. **8:** 192 (1939) as *kamtschatica*. *A. lyrata*, var. *occidentalis* Watson in Gray, Syn. Fl. N. Am. **1:** 159 (1895); Piper in Contrib. U. S. Nat. Herb. **11:** 292 (1906); Rollins in Res. Stud. State Coll. Wash. **4:** 9 (1936). *A. media* var. *glabra* (DC.) Busch, Fl. Sib. Orient. Est. **4:** fam. 25. 465 (1926). *A. media*, var. *intermedia* (DC.) Busch, ibid. *A. kamtschatica*, var. *glabra* (DC.) Busch, ibid. p. 468. *A. kamtschatica*, var. *intermedia* (DC.) Busch, ibid. *A. lyrata*, var. *glabra* (DC.) Hopkins, op. cit. p. 93. *A. lyrata*, subsp. *kamtschatica* (Fisch.) Hultén, Fl. Aleut. Is. 202 (1937). *A. occidentalis* (Wats.) A. Nelson in Univ. Wyoming Pub. **3:** 111 (1937). *Cardaminopsis kamtschatica* (Fisch.) O. E. Schulz in Engler, Pflanzenf. Aufl. 541 **17b:** 2 (1936).—Saskatchewan to Washington, Alaska and the Aleutian Islands; eastern Asia. Map 5. Saskatchewan: 5 miles east of Poplar Pt., Lake Athabaska, July, 1935, *Raup 6684* (G); vicinity of Wolverine Pt., Lake Athabaska, July, 1935, *Raup 6706* (G); Charlot Pt., Lake Athabaska, June, 1935, *Raup 6132* (G). Alberta: Maligne Lake, July, 1908, *Brown 1169* (G); Independence Branch, Pobocton Creek, July, 1908, *Brown 1355* (G); Mt. Temple, Laggan, Aug., 1904, *Butters & Holway a8* (G); vicinity of Lake Louise, July, 1916, *Hunnewell 4356* (G). Washington: Heliotrope Ridge, Mt. Baker, Whatcom Co., Aug., 1934, *Thompson 11239* (G, RM, T, UW); Nooksack River, near Mt. Baker, 1890, *Suksdorf 1999* (G, WSC), specimen cultivated at Bingen, Wash. British Columbia: Lower Allokagnik Lake, 1882, *McKay s.n.* (G); Bishop Range, Selkirk Mts., Aug., 1908, *Butters & Holway 447* (G); Fraser River Valley, May, 1875, *Macoun 132* (G); Carbon River about 4 miles above the Peace River, Aug., 1932, *Raup & Abbe 4267* (G); Mt. Selwyn, July, 1932, *Raup & Abbe 3797, 4096 & 4153* (G). Yukon: Lake Lindeman, head of Yukon R., June, 1883, *Schwatka 19* (G); Klondyke Bottom, Dawson, June, 1914, *Eastwood 191* (Cl, G); Carcross, July, 1914, *Eastwood 708* (Cl, G). Alaska: Sitka, *Bongard s.n.* (G); Admiralty

Is., June, 1915, *Walker 716* (G); Juneau, *Hultén 8112* (L); Skagway, 1910, *Kusche s.n.* (G); Yakutat, June, 1916, *Walker 1055* (G); Seward, June, 1937, *Scamman 525* (G, L); Tutka Bay, Kenai Pen., *Hultén 7776* (L); Rapids Lodge, 138 miles south of Fairbanks, Aug., 1937, *Scamman 1001* (G, L); Mt. McKinley Nat. Park, June, 1937, *Scamman 630* (G, L); vicinity of Karluk, Kodiak Is., June, 1903, *Rutter 29* (G); Olga Bay, Kodiak Is., June, 1936, *E. H. & H. B. Looff 642* (G, R); St. Paul Is., Aug., 1891, *Macoun s.n.* (G); Tanunak, Nelson Is., 1933, *Geist s.n.* (L); Dutch Harbor, Unalaska, June, 1907, *Van Dyke 61* (G); Schumagin Is., July, 1899, *Kincaid s.n.* (L); Nikolski, Umnak Is., *Hultén 5688* (L); Atka Is., *Eyerdam 1144a* (L).

Two varieties of *A. lyrata* were recognized by Hopkins[1] as occurring in northwestern North America, var. *kamchatica* and var. *glabra*. The essential points used to separate them were flower-size and presence or absence of pubescence on the stem and basal leaves. An attempt was made to follow this interpretation, but the study of a large series of specimens has shown that there is considerable variation in flower-size among glabrous plants and that presence in quantity or scantiness of pubescence is not correlated with or confined to either large- or small-flowered forms. Admittedly there is great variation in the characters mentioned, but this variation is not restricted to any given set of characters. The plants as a whole as well as their parts vary tremendously in size. These variations seem to occur in all possible combinations so that it is impossible satisfactorily to split var. *kamchatica* without making innumerable micro-entities. In this case it is preferable to place these plants in a single variety. Hultén[2] reached the same conclusion after a serious study of the variety in Kamtchatka, even though the same forms occur there.

Var. *kamchatica* tends to have broader, usually longer, siliques, coarser stems, shorter styles and less divided basal leaves than var. *typica*. The plants are usually glabrous or very nearly so, which is seldom the case in var. *typica*. The type of var. *kamchatica* has not been seen and it is not known whether one is actually in existence. There is more than a chance that both var. *glabra* and var. *kamchatica* were based on the same collection, since DeCandolle's var. *glabra* (as shown by a photo-

[1] Rhodora **39**: 88–98 (1937).
[2] Fl. Kamtchatka and Adj. Islands **2**: 167 (1928).

graph of the type in the Gray Herbarium) was based on specimens from the herbarium of Pallas communicated to DeCandolle by Fischer in 1819. Var. *kamchatica* was credited to Fischer "in litt" (as a species) by DeCandolle. A summary of the facts shows that there is but a single variety of *A. lyrata* in northwestern North America and Kamtchatka and that var. *kamchatica* is the oldest varietal epithet available for it under this species. The differences between var. *kamchatica* and var. *typica* are not striking nor invariable, and for this reason I do not consider var. *kamchatica* to be a particularly strong variety.

12. A. Davidsonii Greene. Perennial with a deep, simple or branched caudex; stems several, slender, glabrous, simple, 5–15 cm. high; basal leaves oblanceolate-cuneate to spatulate, obtuse, entire or with a few teeth near apex, glabrous, thickish, 3–8 cm. long, 4–12 mm. wide; cauline leaves oblong to cuneiform, entire, few, glabrous, sessile, not auriculate, 6–15 mm. long, 3–6 mm. wide; sepals glabrous, oblong, 4–5 mm. long, 1–1.5 mm. wide; petals spatulate, rounded at apex, white to pinkish, 8–10 mm. long, 2–3.5 mm. wide; glands well developed below single stamens, poorly developed below paired stamens; pedicels divaricate, glabrous, 1–1.5 cm. long; siliques divaricate, glabrous, straight to somewhat falcate, nerved to the middle or above, 3–5 cm. long, 1.5–2 mm. broad; style evident but very short; seeds orbicular, narrowly winged all around, 1.5 mm. broad, uniseriate.—Leaflets **2**: 159 (1911); Jepson, Fl. Calif. **2**: 65 (1936). *A. Lyallii* Watson, var. *Davidsonii* (Greene) Smiley in Univ. Calif. Pub. Bot. **9**: 205 (1921). *A. Brucae* M. E. Jones, Contrib. West. Bot. **14**: 37 (1912). *A. cognata* Jepson, Man. Fl. Pl. Calif. 429 (1925) and Fl. Calif. **2**: 64 (1936).—California and Oregon. Map 8. California: below Sabrina Lake, Bishop Creek, Inyo Co., July 11 (no year given), *A. Davidson 2728* (ND, type; UC, isotype); South Lake, Inyo Co., July, 1913, *A. Davidson 2935* (G); Ledge Trail, Yosemite, *Chandler & Babcock 1033* (UC); Yosemite Valley, July, 1902, *Hall & Babcock 3436* (UC); Little Kern River, Tulare Co., June, 1896, *Purpus 1795* (UC); Mt. Elwell, Plumas Co., July 11, 1912, *Mrs. C. M. Wilder s.n.* (UC, type; US, isotype of *A. cognata*); Slate Creek, Plumas Co., May, 1877, *Mrs. R. M. Austin s.n.* (M, NY, US); Summit, Nevada Co., July, 1902, *M. E. Jones s.n.* (P); Donner Pass, Nevada Co., Aug., 1903, *Heller 7121* (G, M, ND, NY, US); Salmon Lake—Gold Lake, Sierra Co., July, 1921, *H. M. Evans s.n.* (F); Hills near Davis Creek, June, 1898, *Mrs. Austin & Mrs. Bruce 2251* in part (P, type of *A. Brucae*); Redwood Creek, near affluence of the south and middle forks of Kings River, Fresno Co., April,

1939, *Belshaw 5029* (R, UC). Oregon: Baker County, July, 1887, *Cusick 949* (G).

Arabis Davidsonii is distantly related to *A. Lyallii* with which it has been confused and which it resembles in a general way. However, the species is easily distinct and if the caudex-crowns are present, no difficulty should be experienced in determining specimens. The basal leaves and flowers are much larger in *A. Davidsonii* than in *A. Lyallii* and the caudex-crowns differ in being very thick as a result of the old leaf-bases which invest them. The remarkable caudex-branches of this species sometimes penetrate the soil more than a decimeter before they are joined to the principal root. These underground caudex-branches retain the persistent leaf-bases along their entire length, but at the summit of each branch a definite crown from 1 to 3 centimeters across is formed.

The Cusick specimen cited above is apparently typical of the species. It is of interest because of its complete isolation from the known stations for *A. Davidsonii* in California. Perhaps subsequent exploration in the mountains of the intervening area will bring to light new localities for the plant, but the present known distribution for it is unusual.

13. A. Lyallii Watson. Perennial, caespitose; caudex usually branched; stems few to numerous, dwarfed at high altitudes, glabrous, 4–25 cm. high; basal leaves oblanceolate to narrowly linear-oblanceolate, acute to obtuse, entire, narrowly petioled, thin, entirely glabrous or pubescent with small dendritic trichomes, 1–3 cm. long, 3–6 mm. wide (1–2.5 mm. wide in var. *nubigena*); cauline leaves few, remote, lanceolate to oblong, acute, sessile, non-auriculate or sometimes slightly auricled, glabrous or the lower rarely pubescent, 1–2 cm. long, 3–6 mm. wide; sepals oblong, glabrous, non-saccate, green or sometimes purplish, 3.5–4.5 mm. long, about 1.5 mm. wide; petals spatulate, long and narrowly clawed, rose to purplish, (5–) 7–10 mm. long, (1.5–) 2–3 mm. wide; glandular tissue continuous beneath all stamens, moderately developed; siliques erect to slightly divergent, narrowed to a very short style or sessile stigma, one-nerved to the middle, glabrous, 3–5 cm. long, 2–3 mm. wide; seeds orbicular, winged, 1–2 mm. broad, uniseriate to imperfectly biseriate.

13a. Var. **typica.** *A. Lyallii* Watson in Proc. Am. Acad. **11:** 122 (1875) and in Gray, Syn. Fl. N. Am. **1:** 166 (1895); Brewer & Watson, Bot. Calif. **1:** 32 (1876); Greene, Fl. Francisc. 254

(1891); Howell, Fl. Northw. Am. **1:** 44 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906); Coulter & Nelson, New Man. Bot. Rky. Mts. 226 (1909); Rydberg, Fl. Rky. Mts. 359 (1917); Smiley in Univ. Calif. Pub. Bot. **9:** 205 (1921); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 40, fig. 12 (1936). *A. Drummondi* Gray, var. *alpina* Watson in King, Geol. Expl. Fortieth Parallel **5:** 18 (1871); Jepson, Fl. Calif. **2:** 64 (1936); Hopkins in Rhodora **39:** 140 (1937) excl. syn. *A. albertina*. *A. oreophila* Rydberg in Bull. Torr. Bot. Club **34:** 437 (1907) and Fl. Rky. Mts. 359 (1918). *A. armerifolia* Greene, Leaflets **2:** 75 (1910). *A. densa* Greene, ibid. p. 76. *A. multiceps* Greene, ibid. *A. Drummondi* Gray, var. *Lyallii* (Wats.) Jepson, Man. Fl. Pl. Calif. 429 (1925). *A. Drummondi* Gray, var. *oreophila* (Rydb.) Hopkins in Rhodora **39:** 141 (1937).—Alberta and Wyoming to California and British Columbia. Map 3. Alberta: head of Ptarmigan Valley, July, 1906, *Brown 385* (G); Mt. Temple, Laggan, Aug., 1904, *Butters, Holway & Rosendahl a7* (G); Lake O'Hara, Rky. Mt. Park, Aug., 1904, *Macoun 64509* (G); Lake Louise, Rky. Mt. Park, July, 1904, *Macoun 64510* (G, US). Montana: vicinity of Sexton Glacier, Glacier Park, Aug., 1919, *Standley 17224* (US); Logan Pass, Flathead Co., Aug., 1934, *Hodgdon & Rossbach 12 & 13* (G); Glacier Nat. Park, June, 1934, *Maguire et al. 15042* (UAC); MacDougal Peak, Mission Range, July, 1908, *Clemens s.n.* (G); Gallatin Peak, Aug., 1928, *Swingle s.n.* (RM). Wyoming: Union Peak, Aug., 1894, *Nelson 3154* (RM); near Yellowstone Lake, Aug., 1871, *Adams s.n.* (US); mts. near Cottonwood Lake, Lincoln Co., Aug., 1923, *Payson & Armstrong 3788* (G, RM); Teton Mts., Aug., 1894, *Nelson 1007* (US), July, 1901, *Merrill & Wilcox 1253* (US). Idaho: ridge south from Wiessners Peak, July, 1895, *Leiberg 1362* (G, O, RM, US); Packsaddle Peak, Kootenai Co., Aug., 1892, *Sandberg et al. 852* (US); junction of the Selway and Lochsa Rivers, Idaho Co., July, 1937, *Constance & Pennell 1991* (G, R); high ridge west of Cascade, Valley Co., July, 1937, *Thompson 13853* (G, R); Salmon River Mts., near Bonanza, Custer Co., July, 1916, *Macbride & Payson 3393* (G, RM, US); head of Boulder Cr., Sawtooth Mts., Blaine Co., Aug., 1937, *Thompson 14086* in part (R); Twin Lakes, about 11 miles southwest of Obsidian, Blaine Co., Aug., 1939, *Hitchcock & Martin 5727* (R). Utah: Henry's Fork Basin, Summit Co., Aug., 1936, *Maguire et al. 14711* (UAC); La Motte Peak, Uinta Mts., June, 1926, *E. B. & L. B. Payson 5043* (G, RM, US); divide between Big Cottonwood Cañon and Heber Valley, 1905, *Rydberg & Carlton 6678* (NY, type of *A. oreophila*); Twin Lakes, Salt Lake Co., Aug., 1906, *Garrett 1913* (US); Strawberry Valley, Wasatch Mts., Aug., 1883, *M. E. Jones s.n.* (US); White Pine Lake, Mt. Naomi

Region, Cache Co., July, 1936, *Maguire et al. 14091 & 14023* (UAC). NEVADA: East Humbolt Mts. (Clover Mts.), Elko Co., Sept., 1868, *Watson 75* (G, TYPE of *A. Drummondi*, var. *alpina*). Sept., 1910, *Heller 10231* (G); head of Lamoille Creek, about 15 miles southeast of Lamoille, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2547* (G, R). CALIFORNIA: north side of Black Mt., near Kings Castle, Siskiyou Co., July, 1939, *Hitchcock & Martin 5303* (R); Susie Lake, Aug., 1909, *McGregor 132* (US); Gabbot Meadow, Alpine Co., June-July, 1913, *Eggleston 9419* (US); Mt. Dana, Tuolumne Co., July, 1935, *Sharsmith 2077* (UC); Rock Creek Lake Basin, Inyo Co., July, 1934, *Peirson 11295* in part (Peirs), Aug., 1933, *Peirson 10767* (Peirs). OREGON: Wallowa Mts., Wallowa Co., Aug., 1909, *Cusick 3381* (O, WSC); Eagle Cap, Union Co., Sept., 1907, *Sampson & Pearson 206* (US, TYPE of *A. densa*); Blue Mts., head of Anthony Creek, July & Sept., 1899, *Cusick 2245* (G, UC, WSC); Gunsight Peak, near Anthony Lake, Baker Co., July, 1938, *Rollins & Chambers 2633* (G, R); Strawberry Mts., Grant Co., July, 1925, *Henderson 5579* (O); Mount Hood, July-Aug., 1886, *Howell 590* (G, O); middle peak of Three Sisters, July, 1914, *Peck 2723* (O); Mt. Thielson, Aug., 1897, *Coville & Applegate 435* (US, TYPE; RM, isotype of *A. multiceps*); Crater Lake Nat. Park, Sept., 1902, *Coville 1504* (US, TYPE of *A. armerifolia*); Johnson Prairie, Jackson Co., June, 1898, *Applegate 2458* (US). WASHINGTON: Fort Coville to the Rocky Mts., 1861, *Lyall s.n.* (G, TYPE); Ashtnola, Cascade Mts., 1860, *Lyall s.n.* (G); Sheep Mt., Okanogan Co., July-Aug., 1916, *Eggleston 13299* (US); Indian Head Peak, Chelan Co., July, 1921, *St. John 4847* (WSC); Mount Baker, Whatcom Co., Aug., 1923, *St. John 5125* (WSC); Iron Mt., Kittitas Co., June, 1931, *Thompson 6645* (T); Mt. Rainier, Aug., 1897, *Allen 299* (G, UC, UW, WSC); Mt. Adams, Aug., 1882, *T. Howell 557* (G, marked "typical" by Watson); Olympic Mts., Aug., 1895, *Piper 2180* (G, WSC); Hurricane Ridge, Clallam Co., Sept., 1933, *Thompson 14183* (G, R). BRITISH COLUMBIA: Green Mt., near Haylmore, July, 1938, *Thompson 677* (G); between Mt. Wapta and Mt. Field, 1919, *Walcott s.n.* (US).

13b. Var. **nubigena** (Macbride & Payson) comb. nov. Densely caespitose perennial with few to numerous filiform stems, 4–12 cm. high; basal leaves narrowly linear-oblanceolate, 1–1.5 cm. long, 1–2.5 mm. wide, acute, densely pubescent with fine dendritic trichomes to rarely glabrous; cauline narrowly linear; petals pink to purplish, 5–7 mm. long, 1.5–2.5 mm. broad; siliques acute.—*A. nubigena* Macbride & Payson in Contrib. Gray Herb. **49:** 62 (1917). *A. paupercula* Greene, Leaflets **2:** 77 (1910). *A. microphylla* Nutt., var. *nubigena* (Macbride & Payson) Rollins in Res. Stud. State Coll. Wash. **4:** 40 (1936).—California and IDAHO: Smoky Mts., Blaine Co., Aug., 1916, *Macbride*

& Payson 3772 (G, TYPE; RM, UC, US, isotypes); Josephus Lakes, Custer Co., Aug., 1916, *Macbride & Payson 3552* (G, RM); near Sawtooth, July, 1895, *Henderson 3535* (RM, US), July, 1896, *Evermann 656* (US); near Stanley Lake, Custer Co., July, 1937, *Thompson 13997* (T, R). CALIFORNIA: Farewell Gap, April-Sept., 1897, *Purpus 5229½* (US, TYPE; G, isotype of *A. paupercula*); Dana Plateau, Mono Co., July, 1936, *Mason 11417 & 11401B* (UC), Sept., 1936, *C. W. Sharsmith 2413* (G); White Mt., Tuolumne Co., July, 1936, *Mason 11351* (G); Mt. Dana, Tuolumne Co., July, 1933, *C. W. Sharsmith 133B* (UC), July, 1936, *C. W. Sharsmith 2206* (G); Folger Peak, Alpine Co., July, 1913, *Eggleston 9618 & 9641a* (US).

Jepson[1] and Hopkins[2] have recently treated *A. Lyallii* as a variety or varieties (var. *alpina* and var. *oreophila*) of *A. Drummondi*. Since the publications by these authors, I have had the opportunity of examining and comparing this species with *A. Drummondi* both in the field and from greenhouse cultures. At 9,500 feet in the Ruby Mountains of northern Nevada, *A. Lyallii* and *A. Drummondi* were found sharing the same shallow soil covering a granite outcrop. Plants of both species were about the same height (1–2 dm.), but could be readily distinguished when certain characters were carefully noted. In *A. Lyallii* the siliques were somewhat divergent, the seeds in a single row equaled the silique-width and the pubescence, if present, was of a multiple-branching type. *A. Drummondi* had strictly erect siliques, the seeds in two rows were only about half the silique-width and the pubescence, if present, was closely appressed and bifurcate (malpighiaceous). Specimens of *A. Lyallii* (*Rollins & Chambers 2547*) and of *A. Drummondi* (*Rollins & Chambers 2547a*) were collected to demonstrate these points. In the same locality in a more favorable habitat, taller plants of *A. Drummondi* were found (*Rollins & Chambers 2454*). These observations and others, along with a study of the whole question in the laboratory, have convinced me that *A. Lyallii* is not merely an alpine variety of *A. Drummondi* as sometimes supposed, but that it is a discrete biological entity which usually maintains its distinctive characters even when growing side by side with the latter species. In some localities, for example the Olympic Mts. and northern Cascade Mts. of western Washington, there is ap-

[1] Fl. Calif. **2**: 64 (1936).
[2] l. c. p. 140.

parently some crossing where the two species grow in the neighborhood of each other. An occasional plant from either of these areas shows intermediate characteristics between *A. Lyallii* and *A. Drummondi,* but determinations can ordinarily be decisive. In these areas, *A. Holboellii* seems also to cross occasionally with *A. Drummondi* giving a product not so different from a tall plant of *A. Lyallii.*

The pubescent phase of *A. Lyallii* was named *A. oreophila* by Rydberg and reduced to varietal rank under *A. Drummondi* by Hopkins. That the presence of pubescence alone in a supposedly glabrous species is not always taxonomically significant has been demonstrated in other species. In both places where I have collected *A. Lyallii* (northern Nevada and eastern Oregon), pubescent and glabrous plants grew together indiscriminately. That this is true nearly throughout the range of the species is shown by the constant occurrence of both pubescent and glabrous plants on the same sheet in a large percentage of the specimens examined, hence I can see no reason for separating the two nomenclaturally.

The type of *A. paupercula* Greene very well matches the type of *A. nubigena* of Macbride and Payson except that the latter has narrower and shorter leaves. However, other specimens from Idaho are identical in all details with the Sierra Nevada plants. Greene's name has priority as a specific epithet, but *A. nubigena* was first placed in a varietal category, hence the plants must be known as *A. Lyallii,* var. *nubigena.* This variety is also closely related to *A. microphylla* which it resembles in its basal leaves and pubescence. But the broadly winged seeds, nerved siliques and large flowers indicate its real homology to be with *A. Lyallii.* The large gap between central Idaho and the high Sierra Nevada of California makes the distribution of var. *nubigena* rather unusual. However, the range of the very distinctive crucifer, *Anelsonia eurycarpa* is almost identical and there are doubtless other plants with a similar disrupted range.

14 A. Drummondi Gray. Biennial or perennial; stems one to several from a simple caudex, simple or branched above, glabrous to very sparingly appressed-pubescent at base, 3–9 dm. high; basal leaves narrowly oblanceolate to somewhat broader, entire to dentate, petiolate, usually acute, glabrous to pubescent with malpighiaceous trichomes, 2–8 cm. long; cauline leaves oblong to oblong-

lanceolate, acute, sessile, auriculate, usually clasping, glabrous, crowded toward base, fewer above, entire to sparingly dentate, 2–7 cm. long; flowers erect; sepals narrowly oblong, obtuse, glabrous, 3–5 mm. long; petals white to pinkish, 7–10 mm. long; stamens barely exceeding the calyx; pedicels erect, glabrous, 1–2 cm. long; siliques erect, often strict, straight, usually numerous and crowded, glabrous, 4–10 cm. long, 1.5–3 mm. wide, obtuse or rarely subacute; valves 1-nerved to the top or at least above middle; style short or lacking; seeds oblong to slightly broader, prominently winged on distal end and on one side, narrowly winged or wingless on the other side, about 1 mm. wide, 1.5–2 mm. long, biseriate.—Proc. Am. Acad. **6:** 187 (1866) and Man. ed. 5. 69 (1869); Watson in King, Geol. Expl. Fortieth Parallel **5:** 17 (1871) in part; Watson in Gray, Syn. Fl. N. Am. **1:** 166 (1895) in part; Britton & Brown, Ill. Fl. **2:** 150 (1897) in part; Fernald in Rhodora **5:** 230 (1903); Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906); Robinson & Fernald in Gray, Man. ed. 7. 437 (1908); Coulter & Nelson, New Man. Bot. Rky. Mts. 226 (1909); Henry, Fl. So. Brit. Columb. 150 (1918); Rydberg, Fl. Rky. Mts. 359 (1918) and Fl. Pr. Pl. Cent. N. Am. 381 (1932); Jepson, Man. Fl. Pl. Calif. 429 (1925) in part, and Fl. Calif. **2:** 63 (1936) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 43, fig. 13 (1936); G. N. Jones in Univ. Wash. Pub. Biol. **7:** 90 (1939). *A. Drummondi* Gray, var. *typica* Hopkins in Rhodora **39:** 136 (1937). *Turritis stricta* Graham in Edinb. New Phil. Journ. 350 (1829); Hooker, Fl. Bor.-Am. **1:** 40 (1829); Torrey & Gray, Fl. N. Am. **1:** 79 (1838); Gray, Man. 36 (1848) and Gen. Illustr. **1:** 144, t. 59 (1848), not *Arabis stricta* Hudson, Fl. Angl. **1:** 292 (1777). *Streptanthus angustifolius* Nuttall in T. & G., Fl. N. Am. **1:** 76 (1838), not *Arabis angustifolia* Lam., Encycl. **1:** 220 (1883). *Arabis confinis* Watson in Proc. Am. Acad. **22:** 466 (1887) in part and in Gray, Syn. Fl. N. Am. **1:** 163 (1895) in part; Rydberg, Fl. Pr. Pl. Cent. N. Am. 381 (1932). *Erysimum Drummondi* (Gray) O. Ktze., Rev. Gen. Pl. pt. 2: 933 (1891). *A. connexa* Greene in Pitt. **4:** 197 (1900); Rydberg, Fl. Rky. Mts. 359 (1918) and Fl. Pr. Pl. Cent. N. Am. 381 (1932). *A. Drummondi* Gray, var. *connexa* (Greene) Fernald in Rhodora **5:** 231 (1903); Robinson & Fernald in Gray, Man. ed. 7. 437 (1908); Hopkins in Rhodora **39:** 144 (1937). *A. oxyphylla* Greene in Pitt. **4:** 196 (1900). *A. Drummondi* Gray, var. *oxyphylla* (Greene) Hopkins, op. cit. p. 143. *A. albertina* Greene in Pitt. **4:** 196 (1900). *A. philonipha* Nelson ex Rydberg, Fl. Colorado 165 (1906), *nomen nudum*. *Turritis Drummondi* (Gray) Lunell in Am. Midl. Natur. **5:** 236 (1918).—Southern Labrador, Newfoundland and adjacent Quebec south to Delaware and west through the Great Lakes Region

to California, Washington and British Columbia.[1] Map 4. Without definite locality: Rocky Mts., *Nuttall s.n.* (G, NY, isotypes of *Streptanthus angustifolius*); Rocky Mts., 1858, *Bourgeau s.n.* (G). Alberta: Elbow River, Rocky Mts., June–July, 1897, *J. Macoun 18101* (ND, type of *A. albertina;* photo at Gray Herb.); Waterton Lake, July, 1895, *Macoun A1002* (G); Cypress Hills, June, 1894, *Macoun 3071* (G); Maligne Lake, July, 1908, *Brown 1257* (G); base of Mt. Wilson, June, 1908, *Brown 999* (G). South Dakota: near Savoy, Black Hills National Forest, June, 1910, *Murdoch 4117* (G). Montana: Logan Pass, Glacier Park, Aug., 1934, *Hodgdon & Rossbach 3* (G); 12 miles northwest of Wilsall, July, 1921, *Suksdorf 1053* (G, WSC); Bridger Mts., July, 1897, *Rydberg & Bessey 4209* (G); near Melrose, Beaverhead Co., *Bradley 29* (T). Wyoming: base of Beartooth Peak, Park Co., July, 1939, *Rollins & Muñoz 2849* (G, R); Medicine Mt., Big Horn Co., *L. O. & R. Williams 3249* (G, R); Soda Butte Cr., Yellowstone National Park, July, 1899, *A. & E. Nelson 5827* (G, RM); 8 miles west of Wind River, Fremont Co., June, 1936, *Costello & Rollins 2065* (G, R); near Continental Divide, west of Encampment, Sierra Madre, Carbon Co., July, 1936, *Ownbey 1077* (R); Telephone Mines, Albany Co., Aug., 1900, *Nelson 7913* (G, isotype of *A. philonipha*); University of Wyoming Summer Camp, Medicine Bow Mts., Albany Co., July, 1935, *Rollins 1050* (G, R); Vedawoo Glenn, Laramie Hills, July, 1935, *Rollins 991a* (G, R); 15 miles south of Mountain View, Uinta Co., June, 1938, *Rollins & Gates 2372* (G, R). Colorado: 20 miles north of Rifle, Rio Blanco Co., May, 1938, *Rollins 2204* (G, R); Denver Camp, Willow Creek Pass, Grand Co., July, 1935, *Rollins 1028* (G, R); Beaver Creek, Larimer Co., July, 1903, *Goodding 1446* (G); Empire ?, Clear Creek Co., 1875, *E. L. Greene s.n.* (ND, type of *A. oxyphylla;* photo in Gray Herb.); 4 miles north of Como, Park Co., Aug., 1937, *Beetle 2214* (R); 5 miles south of Tincup, Gunnison Co., July, 1936, *Rollins 1439* (G, R); 6 miles northwest of Rio Grande Reservoir, Hinsdale Co., Aug., 1936, *Rollins 1506* (G, R); 30 miles southwest of Montrose, Montrose Co., Aug., 1937, *Rollins 1979* (G, R); near Pagosa Peak, Mineral Co., Aug., 1899, *Baker 341* (ND, type; G, isotype of *A. connexa*). New Mexico: Costilla Park, Taos Co., Sept., 1895, *Mrs. O. St. John 58* (G); Grass Mt., Pecos River Nat. Forest (now the Santa Fe Nat. Forest), June, 1908, *Standley 4069* (G). Idaho: divide between St. Joe and Clearwater River, July, 1895, *Leiberg 1212* (G, RM); near Bonanza, Custer Co., July, 1916, *Macbride & Payson 3426* (G, M, UC, US); above Redfish Lake, Aug., 1916, *Macbride & Payson 3659* (G, M, RM); Cherry Creek Divide,

[1] For citations of specimens from east of the one-hundredth meridian see Hopkins, op. cit. pp. 137–139.

Custer Co., July, 1939, *Davis 1554* (G, R); Wild Horse Creek, Custer Co., July, 1939, *Davis 1207* (R); Frazier Dam, Clark Co., June, 1938, *Davis 338* (G, R); Galena Pass, Blaine Co., June, 1938, *Davis 448* in part (R). Utah: Big Cottonwood Canyon, Salt Lake Co., July, 1905, *Garrett s.n.* (G); Alta, Wasatch Mts., Aug., 1879, *M. E. Jones 1177* (G); Stillwater Fork, Uinta Mts., Summit Co., July, 1926, *E. B. & L. B. Payson 4980* (G); 30 miles south of Manila, Uintah Co., June, 1937, *Rollins 1764* (G); above White Pine Lake, Bear River Range, Cache Co., *Maguire & Hobson 14221* (G); near Delano, Beaver Co., July, 1934, *Hodgdon & Rossbach 71* (G); La Sal Mts., Grand Co., July, 1924, *E. B. & L. B. Payson 3945* (G); West Mt., Abajo Mts., San Juan Co., June, 1932, *Maguire & Redd 1853* (UAC); Blue Spring Ranger Station, Sevier Forest, Garfield Co., July, 1912, *Eggleston 8389* (NA). Arizona: North Rim, Grand Canyon of the Colorado, June, 1933, *Eastwood & Howell 967* (G). Nevada: Hinkey Summit, Santa Rosa Range, Humboldt Co., July, 1937, *Train 281* (R); base of Mt. Wheeler, White Pine Co., July, 1938, *Rollins & Chambers 2486* (G, R); 3 miles south of Preston, White Pine Co., June, 1937, *Moore & Franklin 716* (NA, R); head of Lamoille Creek, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2545* (G, R); 8 miles west of North Fork, Elko Co., July, 1937, *Nichols & Lund 301* (R). California: Eagle Meadow, Tuolumne Co., July, 1936, *Hoover 1476* (R); Mono Pass, Tuolumne River, 1863, *Brewer s.n.* (G); Tioga Crest, Sierra Nevada, Mono Co., July, 1936, *Mason 11464* (UC); Virginia Lakes Basin, Mono Co., July, 1934, *Peirson 11233* (Peirs); South Lake, Bishop Creek, Inyo Co., July, 1929, *Peirson 8517* (Peirs). Oregon: Elk Horn Mts., west of North Powder, Baker Co., Aug., 1915, *Peck 2710* (W); base of Gunsight Peak, Blue Mts., Baker Co., July, 1938, *Rollins & Chambers 2630* (G, R). Washington: Angels Pass, Okanogan Co., June, 1931, *Thompson 7044* (G); Heliotrope Ridge, Mt. Baker, Aug., 1937, *Muenscher 7883* (G); Sourdough Mt., Whatcom Co., Aug., 1937, *Muenscher 7884* (G); Stevens Pass, Aug., 1893, *Sandberg & Leiberg 764* (WSC); White River, Mount Rainier Park, June, 1937, *G. N. Jones 10002* (G); north of Mt. Adams, Aug., 1892, *Henderson 2397* (G, UW); Mt. Angeles, Clallam Co., July, 1931, *Thompson 7427* (G), July, 1931, *J. T. Howell 7471* (G); Mount Constance, Jefferson Co., Aug., 1938, *Rollins & Chambers 2652* (G, R, DS). British Columbia: Bluster Mt., Marble Mts., July, 1938, *J. & E. Thompson 404* (G); Cornwall Hills, July, 1894, *McEvoy 5097* (G); Emerald Lake, June, 1929, *Peterson 52* (G); Mount St. Thomas, Aug., 1902, *Macoun 63499* (G); Lake Atlin, July, 1914, *Eastwood 638* (Cl, G); Mt. Selwyn, July, 1932, *Raup & Abbe 4081* (G).

The unreliability of the presence or absence of pubescence

as a criterion for the separation of certain species and varieties of *Arabis* has been stressed above, but this point must be particularly emphasized in the case of *A. Drummondi*. This wide-ranging species tends toward a glabrous condition in the eastern portion of its range, while the dominant form along the Rocky Mountain axis has strigose basal leaves. However, it is significant that one finds specimens possessing strigose trichomes from scattered stations in Massachusetts, Connecticut, Vermont, New York, Michigan and Ontario in the eastern half of North America. Westward, where the strigose form prevails, glabrous plants are also abundant and may be found throughout most of the Rocky Mountain region. The sporadic occurrence of pubescent forms nearly throughout the range of *A. Drummondi* is not, in my opinion, taxonomically significant. This character appears to be dependent upon the age of the plant and the environmental circumstances under which it grew. These two points were studied in several greenhouse- and two field-cultures obtained from seeds of *A. Drummondi* gathered in Colorado (*Rollins 1506*). The young leaves under both greenhouse and field conditions were evenly strigose on both surfaces. On greenhouse-grown plants the trichomes remained evenly spaced over the leaf-surfaces on fully matured or even old basal leaves, although the distance between trichomes was considerably greater than on young leaves. The mature basal leaves of field-cultures behaved differently with respect to vestiture. Here, the older basal leaves became completely glabrous or a few hairs remained along the leaf-margins. The pubescence had evidently been shed. Assuming that the same thing takes place in nature and in view of the fact that the pubescent form of *A. Drummondi* has no distinctive geographic range of its own, I find it desirable to discontinue *A. oxyphylla* Greene as a taxonomic entity even in varietal rank as Hopkins, op. cit. p. 143, placed it.

A broad-podded form of *A. Drummondi* was segregated as *A. connexa* by Greene and has more recently been maintained in varietal rank. This form occurs at widely separated locations in the range of the species and is doubtfully a natural biological entity. The broad-podded form of *A. Drummondi* represents the one extreme in pod-width and should be more naturally included as an integral part of the species proper rather than as

a variety of it. My collection, number 1439 from Gunnison County, Colorado, was purposely selected from a colony of broad-podded plants to illustrate this form. In the dry meadow from which these plants came nearly the complete range of pod-width found in *A. Drummondi* might have been collected from the various colonies present. Field observations indicate that the broad-podded forms and the noticeably narrow-podded forms tend to grow in colonies, hence, pod-size appears to be genetically controlled. This does not mean that the factors controlling all degrees of pod-size are lacking in plants with one extreme or the other. Plants with extreme pod-width, since they are of random occurrence, may be due to some type of genetical segregation.

The great variation in the size of the gross morphological structures in *A. Drummondi* is partially due to its aggressive nature, at least in western America. The species is quick to inhabit disturbed soils, where it becomes abnormally large and vigorous. In western America the flowers are usually white, but may be tinged with pink. Flowering specimens with pink or purple flowers which seem to belong to *A. Drummondi* are apt to prove to be *A. Lyallii* or *A. divaricarpa* upon closer examination.

15. A. DIVARICARPA A. Nelson. Biennial or rarely perennial; stems one or few from a simple or branching caudex, simple or branched above, pubescent below with appressed trichomes or glabrous throughout (except in var. *interposita* which is pubescent both above and below), 3–9 dm. high; basal leaves broadly oblanceolate to narrowly spatulate, usually acute, dentate to subentire, loosely pubescent with three- to several-rayed trichomes, pubescence usually appressed, 2–6 cm. long, 4–8 mm. wide; cauline leaves narrowly oblong to lanceolate, entire or the lower sometimes dentate, glabrous or the lower sparsely pubescent (except in var. *interposita* which often has all the leaves sparsely pubescent), auriculate and often sagittate; sepals oblong, glabrous to sparsely pubescent, scarious-margined, 3–5 mm. long; petals spatulate, pink to purplish, 6–10 mm. long; pedicels divaricate to loosely descending, slender, glabrous (pubescent in var. *interposita*), 6–12 mm. long; siliques straight or rarely very slightly curved, loosely ascending, divaricate or less frequently nearly pendulous, glabrous, nerved to middle or nearly entire length, 2–8 cm. long, 1.5–2.5 mm. wide; style very short or absent; seeds broadly oblong to nearly orbicular, narrowly winged, about 1 mm. wide, uniseriate or imperfectly biseriate.

Pedicels and upper stems glabrous, lower stems glabrous to sparsely pubescent with malpighiaceous trichomes.....15a. Var. *typica.*
Pedicels and upper stems usually pubescent with three- to four-parted trichomes, lower stems pubescent with several-branched trichomes.....15b. Var. *interposita.*

15a. Var. TYPICA Hopkins in RHODORA **39:** 130 (1937). *A. divaricarpa* A. Nelson in Bot. Gaz. **30:** 193 (1900); Coulter & Nelson, New Man. Bot. Rky. Mts. 226 (1909); Rydberg, Fl. Rky. Mts. 362 (1918); Tidestrom in Contrib. U. S. Nat. Herb. (Fl. Utah and Nevada) **25:** 244 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 45 (1936). *Turritis brachycarpa* T. & G., Fl. N. Am. **1:** 79 (1838); Walpers, Rep. **1:** 130 (1842); Gray, Man. 37 (1848). *Arabis Drummondi,* var. *brachycarpa* (T. & G.) Gray, Man. ed. 5. 69 (1867). *A. confinis* Watson in Proc. Am. Acad. **22:** 466 (1887) in part and in Gray, Syn. Fl. N. Am. **1:** 163 (1895) in part. *A. confinis,* var. *brachycarpa* (T. & G.) Watson & Coulter in Gray, Man. ed. 6. 67 (1889); Watson in Gray, Syn. Fl. N. Am. **1:** 163 (1895). *A. brachycarpa* (T. & G.) Britton in Mem. Torr. Bot. Club **5:** 174 (1894); Fernald in RHODORA **5:** 231 (1903); Robinson & Fernald in Gray, Man. ed. 7. 437 (1908); Rydberg, Fl. Rky. Mts. 361 (1918) and Fl. Pr. Pl. Cent. N. Am. 381 (1932); Marie-Victorin, Fl. Laurent. 261 (1935); not *A. brachycarpa* Ruprecht, Fl. Cauc, 73 (1869). *A. oblanceolata* Rydberg in Bull. Torr. Bot. Club **31:** 557 (1904); Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909); Rydberg, Fl. Rky. Mts. 359 (1918). *A. pratincola* Greene in Fedde, Repert. Nov. Sp. **5:** 344 (1908). *A. Drummondi,* var. *pratincola* (Greene) Hopkins in RHODORA **39:** 142 (1937). *A. nemophila* Greene, Leaflets **2:** 78 (1910). *A. dacotica* Greene, ibid. p. 80. *A. brevisiliqua* Rydberg, Bull. Torr. Bot. Club **39:** 326 (1912). *A. Stokesiae* Rydberg, Fl. Rky. Mts. 361 (1918).—Quebec[1] to northern New York, Great Lakes region, interruptedly westward to the Rocky Mountains and California, north to Yukon and Alaska. MAP 7. SASKATCHEWAN: without locality, 1858, *E. Bourgeau s.n.* (G); vicinity of Charlot Point, Lake Athabaska, June, 1935, *Raup 6111* (G); Cypress Hills, June, 1894, *J. Macoun 3072* (G). ALBERTA: vicinity of Fort Chipewyan, June, 1935, *Raup 6068* (G), *Raup 6067* (G); Rosebud Valley, May, 1915, *Moodie 855* (G); discharge of Lake Louise, July, 1904, *J. Macoun 64514* (G, M, NY); below Wapta Lake, Rky. Mt. Park, Aug., 1904, *J. Macoun 64513* (G, NY); Laggan, Rky. Mt. Park, June, 1904, *J. Macoun 64518* (G); shore of Waterton Lake, July, 1895, *J. Macoun A1004* (G); opposite Cataract Pass, headwaters of the Saskatchewan and Athabasca Rivers, June, 1908, *Brown 1044* (G). SOUTH DAKOTA: near Deadwood, Lawrence Co.,

[1] For citations of specimens from east of the one-hundredth meridian see Hopkins, op. cit. pp. 130–132.

June, 1929, *Palmer 37164* (G); Custer Peak, Black Hills, 1927, *Hayward 1749* (F); Fort Meade, May, 1887, *Forwood 28* (US, TYPE; G, isotype of *A. dacotica* Greene). MONTANA: Glacier Park, July, 1931, *Pease 22328* (G); about 13 miles west of Browning, Glacier Co., Aug., 1934, *Hodgdon & Rossbach 72* (G); Daly Creek, Granite Co., Aug., 1933, *C. L. Hitchcock 2067* (G); Missoula, May, 1921, *Kirkwood 1130* (Cl); Bozeman, June, 1900, *Blankinship s.n.* (M); near Wilsall, Park Co., July, 1921, *Suksdorf 531* (G, R); West Yellowstone, Gallatin Co., July, 1920, *E. B. & L. B. Payson 1925* (G, RM); 10 miles southwest of Red Lodge, Carbon Co., July, 1939, *Rollins & Muñoz 2819* (G, R). WYOMING: Yellowstone Lake, Yellowstone National Park, Aug. 6, 1899, *A. & E. Nelson 6332* (RM, TYPE), Aug 23, 1899, *A. & E. Nelson 6622* (G); 5 miles west of Beartooth Lake, Park Co., July, 1939, *Rollins & Muñoz 2858* (G, R); Jackson's Hole, Lincoln Co., Aug., 1920, *E. B. & L. B. Payson 2194* (G, RM); near Afton, Lincoln Co., July, 1923, *Payson & Armstrong 3367* (G); Newcastle, Weston Co., June, 1893, *Bates s.n.* (G); 7 miles northwest of Hulett, Crook Co., June, 1935, *Ownbey 551a* (G); Centennial, Albany Co., July, 1902, *Nelson 8735* (G). COLORADO: Spicer, Larimer Co., July, 1903, *Goodding 1513* (G); eastern slope of Fall River Pass, Rocky Mountain National Park, Aug., 1937, *Rollins 1884* (G, R); East Tennessee Cr., about 10 miles north of Leadville, Lake Co., July, 1936, *Rollins 1401* (G, R); western slope of Monarch Pass, 1 mile from summit, Chaffee Co., July, 1936, *Rollins 1343* (G, R); 2 miles south of Pitkin, Gunnison Co., July, 1936, *Rollins 1426a* (G); near the Alvrado Ranger Station, Custer Co., June, 1936, *Rollins 1245* (G, R); lower slope of Mt. Carbonate, 20 miles west of Gardner, Huerfano Co., June, 1936, *Rollins 1258* (DS, G, R); mountains above Silverton, San Juan Co., July, 1934, *Hodgdon & Rossbach 7* (G); Valley Spur, Sept., 1901, *Underwood & Selby 454* (NY, TYPE of *A. oblanceolata*); Ridgway, Ouray Co., June, 1924, *E. B. & L. B. Payson 3850* (G, M). IDAHO: ridges south from Wiessners Peak, Kootenai Co., July, 1895, *Leiberg 1374* (G, M); Lookout, Priest River Experiment Station, July, 1923, *Epling 5872* (UCLA); Lolo Trail, Idaho Co., July, 1937, *Constance & Pennell 2020* (G, R); Birch Creek, Lemhi Co., June, 1939, *Davis 1098* (R); Frazer Dam, Clark Co., June, 1938, *Davis 340* (R); Henry Lake, Fremont Co., July, 1920, *E. B. & L. B. Payson 1984* (G); near Clayton, Custer Co., July, 1916, *Macbride & Payson 3386* (G, RM, UC); near Clyde, Blaine Co., July, 1916, *Macbride & Payson 3136* (G, RM, US); Meadow Creek Ranger Station, Bear Lake Co., June, 1936, *Davis 395* (R). UTAH: inlet to White Pine Lake, Mt. Naomi region, Cache Co., July, 1936, *Hoyt 15267* (G, R); Stillwater Fork, Uinta Mts., Summit Co., July, 1926, *E. B. & L. B. Payson 4967* (G); 25 miles south of

Manila, Uintah Co., June, 1937, *Rollins 1767* (DS, G, R); 18 miles north of Vernal, Uinta Mts., Uintah Co., June, 1937, *Rollins 1760a* (DS, G, R); Parley's Canyon, Wasatch Mts., June, 1901, *S. G. Stokes s.n.* (NY, TYPE of *A. Stokesiae*). NEVADA: West Humboldt Mts., June, 1886, *Watson 74 ?* in part (G); head of Lamoille Creek, about 15 miles southeast of Lamoille, Ruby Mts., Elko Co., July, 1938, *Rollins & Chambers 2546* (G, R); Jack Creek, 70 miles northwest of Elko, Elko Co., June, 1937, *Nichols & Lund 213* (R); 1 mile south of Marlette Lake, Sierra Nevada Range, Ormsby Co., July, 1939, *Train 3213* (G); Spooner, Douglas Co., June, 1902, *Baker 1149* (G, M, isotypes of *A. pratincola*). CALIFORNIA: rocky gulch off Jaynes Canyon, Siskiyou Mts., Siskiyou Co., Aug., 1934, *Wheeler 3053* (G); south fork of Salmon River, near Big Flat, Siskiyou Co., July, 1937, *J. T. Howell 13205* (G, R); near Castle Peak, Nevada Co., July, 1903, *Heller 7069* (G, M, NY, US); White's Creek Lake, Trinity Co., Aug., 1935, *Tracy 14692½* (UC); Donner Pass, Placer Co., July, 1919, *Heller 13319* (G); near Lake Alpine, Alpine Co., July, 1935, *Peirson 11573* (Peirs); Wheats Meadow Ranger Station, Stanislaus Forest, Tuolumne Co., June, 1918, *Eggleston 9282* (NA); east slope of Sonora Pass, July, 1932, *Peirson 10380* (Peirs); Rock Creek Lake Basin, Inyo Co., July, 1932, *Peirson 9456* (Peirs); Farewell Gap, Tulare Co., Aug., 1904, *Culbertson 4523* (G, M); near Mineral King, Tulare Co., Aug., 1891, *Coville & Funston 1450* (G); Sequoia National Forest, July, 1908, *A. Davidson 1847* (US, TYPE of *A. nemophila*). OREGON: Powder River Mts., Aug., 1896, *Piper 2507* (G, WSC); Strawberry Mt., Grant Co., July, 1925, *Henderson 5579* (G); Pine Creek, Baker Co., Aug., 1915, *Peck 2706* (W); head of Divine Creek, Steens Mts., June, 1901, *Cusick 2570* (G); 10 miles south of McKenzie Bridge, Lane Co., July, 1914, *Peck 2708* (G); Sparks Lake, Deschutes Co., July, 1931, *J. T. Howell 7139* (G); Ashland Butte, July, 1886, *Henderson 13* (G); near Lake-of-the-woods, Klamath Co., July, 1936, *Thompson 13138* (R). WASHINGTON: Godman Springs, Columbia Co., July, 1935, *Constance et al. 1178* (G, R, WSC); above Slate Creek, Barron, Whatcom Co., June, 1939, *Muenscher 10089* (G); Chiwaukum Cr., Chelan Co., Aug., 1916, *Eggleston 13534* (US); Table Mt., Kittitas Co., Aug., 1933, *Thompson 9778* (NY); Wenas Cattle Camp, Kittitas Co., July, 1937, *Caples & Spence 74* (FS); American River Canyon, above Union Creek, Yakima Co., June, 1936, *Eastwood & Howell 2983* (R); Cowlitz Ridge, Mt. Rainier, Pierce Co., Aug., 1919, *Flett 3162* (WSC). BRITISH COLUMBIA: Skagit Valley, July, 1905, *Macoun 70824* (G); July 6, 1905, *Macoun 70825* (NY, TYPE of *A. brevisiliqua*); near Lake Bootahnie, Marble Mts., June, 1938, *J. W. & E. M. Thompson 65* (G); Carson Mt., Marble Mts., June, 1938, *J. W. & E. M.*

Thompson 330 in part (G). Yukon: Dawson, June, 1914, *Eastwood 246* (G); Fort Selkirk, June, 1899, *Gorman 1008* (Can). Alaska: Mt. McKinley National Park, June, 1937, *Scamman 633* (G, L, R); between Anchorage and Curry, June, 1937, *Scamman 568* (G); between miles 52 and 65, Richardson Highway, *Anderson 1972* (L); Matanuska, *Anderson 1105* (L); Robertson River, June, 1921, *Murie 101* (L).

15b. Var. **interposita** (Greene), comb. nov. Stems usually simple, single, pubescent to the inflorescence; pedicels sparsely pubescent; siliques nerveless or nearly so.—*A. interposita* Greene, Leaflets **2:** 78 (1910). *A. acutina* Greene, ibid. p. 82. *A. Drummondi* Gray, var. *interposita* (Greene) Rollins in Res. Stud. State Coll. Wash. **4:** 45 (1936).—Southwestern Oregon and northern California. California: Spirit Lake, Marble Mts., Siskiyou Co., Aug., 1939, *J. T. Howell 14952* (G, R); Marble Mt., Siskiyou Co., June, 1901, *Chandler 1630* (UC); Log Lake, Siskiyou Co., June, 1910, *Butler 1537* (P); Caribou Basin, Siskiyou Co., July, 1937, *J. T. Howell 13551* (G, R); Trinity Summit, Humboldt Co., July, 1932, *Tracy 10396* (G, P). Oregon: Diamond Lake, Douglas Co., June, 1931, *J. T. Howell 6857* (G); Ashland Butte, Siskiyou Mts., and Crater Lake, Cascade Mts., July 14, Aug. 22, 1902, *Cusick 2970* (US, type as to plant in center of sheet; G, isotype as to plant on left of sheet); Crater Lake National Park, Aug., 1916, *Heller 12630* (G); Mt. Thielson, Aug. 6, 1897, *Coville & Leiberg 343* (US, type; RM, isotype of *A. acutina*); near Oregon Caves, July, 1918, *Peck 8276* (G, W).

The distribution of *A. divaricarpa* parallels in a general way that of *A. Drummondi* and these two species are very closely related. In fact, the relationship is so close that some natural hybridization apparently occurs. In the main, each species has a characteristic type of pubescence, but on occasional specimens a mixture of malpighiaceous and more highly branched hairs is found. These specimens usually resemble *A. divaricarpa* and are often so determined. However, other traces of "*Drummondi*" besides pubescence are frequently found, such as broader and more erect siliques and a tendency to have the seeds in two rows instead of the usual single row. *A. divaricarpa* is extremely variable as regards the position of the mature silique. Ordinarily the siliques diverge upward from the rachis at an angle of about 45°, but variations from nearly erect to a widely pendulous position are frequent. Different plants of *A. divaricarpa* possess trichomes of different sizes and specimens may

be arranged in two series on the basis of coarseness or fineness of the pubescence. This difference in trichome-size, together with the knowledge that polyploidy is found in the species, led to the investigation of size of pollen-grains in the two series, but no appreciable differences could be detected. No attempt was made to correlate stoma-size or -distribution with trichome-size in this species, although the accumulation of such data together with chromosome-counts on a selected series of plants would probably be profitable.

Two collections from Michigan, *Fernald & Pease 3334* and *Pease & Ogden 25181,* are notable because the silique-position is similar to that of *A. Holboellii* in being loosely descending and often secund. The superficial resemblance of these plants to *A. Holboellii* led Hopkins, op. cit. pp. 171 and 174, to attribute this species to the Keweenaw Peninsula of Michigan. A careful examination of the two collections shows that the pubescence is exactly the same as on other specimens of *A. divaricarpa* from the same area and is quite different from that of *A. Holboellii.* Pubescence-type is far more significant than pedicel- or silique-orientation in *Arabis* generally, hence one must conclude that the plants in question are actually *A. divaricarpa* instead of *A. Holboellii* as determined by Hopkins.

In another paper on *Arabis,* op. cit. p. 45, I treated certain plants of southern Oregon as *A. Drummondi,* var. *interposita.* These plants were later partly included by Hopkins, op. cit. p. 142, in *A. Drummondi,* var. *pratincola.* This separation from typical *A. Drummondi* was made because the stems and leaves were pubescent with several-branched hairs instead of being glabrous or pubescent with appressed bifurcate trichomes. In reconsidering the plants, I find that while they are somewhat intermediate between *A. Drummondi* and *A. divaricarpa,* they are really more closely related to the latter species and constitute a variety with more pubescent stems, pubescent pedicels and more erect siliques. *A. pratincola* is too near typical *A. divaricarpa* to be included in the variety.

16. A. FRUCTICOSA A. Nelson. Perennial; stems numerous from a branching base, glabrous and glaucous, abundantly branched, 4–6 dm. high; basal leaves oblanceolate to spatulate, obtuse to acute, not rounded at apex, rather sharply dentate to rarely entire, about 2 cm. long, 4–7 mm. wide, sparsely pubescent with

minute dendritic trichomes; cauline leaves glaucous, ovate to broadly oblong, sessile, auriculate, remote, 10–15 mm. long, 4–7 mm. wide, lower sparsely pubescent, dentate, upper entire and glabrous; sepals oblong, sparsely pubescent to glabrous, 2–3 mm. long; petals pink to purplish, spatulate, 5–7 mm. long; pedicels divaricately descending, glabrous, 6–10 mm. long; siliques glabrous and glaucous, divaricately spreading, straight to slightly curved, nerveless to slightly nerved near base, 4–6 cm. long, 1.5–2 mm. wide; seeds orbicular, narrowly winged, uniseriate, about 1.5 mm. broad.—Bot. Gaz. **30:** 190 (1900); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 362 (1918).—Wyoming: Undine Falls, Yellowstone National Park, July 6, 1899, *A. & E. Nelson 5681* (RM, type; G, NY, isotypes).

A. fructicosa is known only from the type collection, hence the normal range of variation cannot be determined. The species is apparently related to *A. divaricarpa* from which it is distinguished by having ovate instead of oblong cauline leaves, a much-branched caudex in place of a simple base and minute dendritic trichomes on the basal leaves instead of having them coarse and few-branched. *A. fructicosa* has some of the features of *A. Lemmoni,* var. *drepanoloba*, but the two are apparently not closely related. In the summer of 1939, attempts were made to re-collect *A. fructicosa* in Yellowstone National Park, but the species could not be found. However, the exact type station was not visited.

17. A. **rigidissima,** sp. nov. Herba perennis basi suffruticosa; caulibus glabris vel inferne sparse pubescentibus, 2–4 dm. altis; foliis radicalibus glabris vel sparse pubescentibus spathulatis integris obtusis 1.5–3 cm. longis, 4–8 mm. latis; foliis caulinis ovatis vel oblongis sessilibus auriculatis integris glabris 1–2 cm. longis, 4–8 mm. latis; sepalis glabris oblongis 4–5 mm. longis 1.5–2 mm. latis; petalis spathulatis roseis 7–9 mm. longis; pedicellis glabris divaricato-adscendentibus 5–10 mm. longis; siliquis divaricato-adscendentibus glabris acuminatis 5–7 cm. longis, 2.5–3.5 mm. latis; seminibus oblongis vel orbicularibus alatis 2–2.5 mm. latis, uniseriatis.

Perennial; stems one to several from a naked simple or branching suffruticose caudex, sparingly pubescent below or glabrous throughout, simple or branched below, 2–4 dm. high; basal leaves spatulate, entire, obtuse, short-petioled, sparsely pubescent with rather fine dendritic or forked, spreading trichomes or usually glabrous, 1.5–3 cm. long, 4–8 mm. wide; cauline leaves ovate to oblong, sessile, auriculate, entire, coriaceous, usually

remote, glabrous or the lower rarely sparsely pubescent, 1–2 cm. long, 4–8 mm. wide; sepals glabrous, oblong, scarious-margined, 4–5 mm. long, 1.5–2 mm. broad, outer pair very slightly saccate; petals spatulate, tapering gradually to a fairly broad claw, pink, 7–9 mm. long, 2.5–3.5 mm. broad; glands well developed, continuous beneath all stamens; pedicels glabrous, divaricately ascending, 5–10 mm. long; siliques straight, divaricately ascending, glabrous, strongly nerved to the middle or slightly above, acuminate, 5–7 cm. long, 2.5–3.5 mm. wide; style less than 1 mm. long; seeds slightly oblong to orbicular, narrowly winged, 2–2.5 mm. broad, uniseriate.—Northwestern California: Mary Blaine Mt., Trinity Co., Aug. 3, 1935, *J. P. Tracy 14469* (G, type; UC, isotype); head of White's Creek, Devils Canyon Mts., Trinity Co., Aug., 1935, *Tracy 14536* (R, UC); White's Creek Lake, Devils Canyon Mts., Trinity Co., Aug., 1935, *Tracy 14668½* (UC); Trinity Summit, head of Devils Hole, Humboldt Co., July, 1935, *Tracy 14319½* (UC).

The siliques of *A. rigidissima* resemble those of *A. suffrutescens* in being broad with an uneven, somewhat undulate margin and acuminate apex. The disposition and shape of the leaves and the general habit of growth are also very similar in the two species. *A. rigidissima* is distinct from *A. suffrutescens* on the basis of its narrower ascending instead of reflexed siliques and narrowly instead of broadly winged seeds. The latter character is fundamental and immediately sets the two species apart. The siliques are borne in a divaricately ascending position in *A. rigidissima* similar to the silique-position in *A. divaricarpa* which it superficially resembles. However, these two species are not particularly related and differ in the form of silique, size of seeds, size of flower parts and shape and disposition of the leaves. In many ways *A. rigidissima* represents a transitional type between that group of species with broad siliques and widely winged seeds of which *A. suffrutescens* and *A. platysperma* are representative, and the more abundant group in *Arabis* with narrow siliques and narrowly winged seeds. The silique-position is also that of *A. platysperma,* but our plant does not have the very broadly winged seeds characteristic of the latter species.

18. A. Lemmoni Watson. Deep-rooted perennial; stems several to numerous from a branching caudex, slender, simple, pubescent throughout or usually glabrous above, 6–20 (–40) cm. high; basal leaves broadly spatulate-oblanceolate (much nar-

rower in var. *depauperata*), entire to few-toothed, usually obtuse, densely pubescent with minute dendritic trichomes, pannose (except in var. *paddoensis*), 1–2 cm. long; cauline leaves sessile, oblong-lanceolate to somewhat ovate, auriculate and slightly clasping, glabrous or the lower pubescent (all pubescent in var. *depauperata*), 4–10 (–15) mm. long; sepals oblong, obtuse, nonsaccate, glabrous to sparsely pubescent, often purplish, 2–3 mm. long; petals pink to purple, spatulate, 4–6 mm. long; glandular tissue moderately developed, continuous beneath all stamens; pedicels glabrous or rarely pubescent, 2–5 mm. long; siliques usually horizontal, sometimes slightly ascending or somewhat pendent (divaricately ascending in var. *depauperata*), straight to slightly curved, glabrous, nerved to the middle, 2–4 (–5) cm. long, 2–3.5 mm. wide; stigma sessile or the style very short; seeds orbicular, narrowly winged, slightly more than 1 mm. broad, uniseriate.

Key to the Varieties of A. Lemmoni

Siliques divaricately ascending; basal leaves narrowly oblanceolate to lanceolate; fruiting raceme not secund..18d. Var. *depauperata*.
Siliques horizontal or slightly descending; basal leaves spatulate; fruiting raceme usually somewhat secund.
  Basal leaves sparsely pubescent to glabrous.....18b. Var. *paddoensis*.
  Basal leaves densely pubescent, usually pannose.
    Siliques 2–2.5 mm. broad, 2–4 cm. long; stems numerous, less than 2 dm. high.....18a. Var. *typica*.
    Siliques 2.5–3.5 mm. broad, 3–5 cm. long; stems few, 2–4 dm. high.....18c. Var. *drepanoloba*.

18a. Var. **typica.** *A. Lemmoni* Watson in Proc. Am. Acad. **22:** 467 (1887) and in Gray, Syn. Fl. N. Am. **1:** 166 (1895); Howell, Fl. Northw. Am. **1:** 44 (1897); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 360 (1918); Henry, Fl. So. Brit. Columb. 149 (1918); Jepson, Man. Fl. Pl. Calif. 430 (1925) in part and Fl. Calif. **2:** 65 (1936) in part; Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925); Rollins in Res. Stud. State Coll. Wash. **4:** 36, fig. 10 (1936). *A. canescens* Nuttall, var. *latifolia* Watson in King, Geol. Expl. Fortieth Parallel **5:** 17 (1871). *A. latifolia* (Watson) Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906). *A. bracteolata* Greene, Leaflets **2:** 73 (1910). *A. Kennedyi* Greene, ibid. p. 71. *A. oreocallis* Greene, ibid. p. 73. *A. polyclada* Greene, ibid. p. 75. *A. semisepulta* Greene, ibid. p. 74. *A. Egglestonii* Rydberg, Fl. Rky. Mts. 361 (1918).—Montana to Colorado, California and British Columbia. Map 9. Montana: Glacier Park, Aug., 1919, *Standley 17737* (US), July, 1933, *C. L. Hitchcock 2043* (P); Black Butte, Tobacco Root Range, Aug., 1902, *Blankinship s.n.* (G); Blackfoot Glacier, Aug., 1909, *M. E. Jones s.n.* (P); Bridger Mts., June, 1897, *Rydberg & Bessey 4223* (G);

Lone Mt., Gallatin Co., Aug., 1906, *Roadhous & Chestnut 29* (UC), June, 1901, *W. W. Jones s.n.* (G, RM, UC); Crazy Mts., Park Co., July, 1902, *Blankinship s.n.* (RM). WYOMING: Fremont Peak, Aug., 1878, *C. Richardson s.n.* (G); Beartooth Butte, Park Co., July, 1939, *Rollins & Muñoz 2838* (G, R), Aug., 1937, *L. O. & R. P. Williams 3760* (R); northwestern Wyoming, Aug., 1893, *Rose 399a* (US, TYPE of *A. bracteolata*); Mt. Washburn, July, 1932, *B. & R. Maguire 1169* (UAC); Piney Mt., July, 1922, *E. B. & L. B. Payson 2674* (G, US); Teton Pass Mts., July, 1920, *E. B. & L. B. Payson 2135* (G). COLORADO: Clover Mt., above Garfield, July, 1910, *Eggleston 6013* (NY, TYPE; US, isotype of *A. Egglestonii*). IDAHO: Brazil's, Birch Creek, Lemhi Co., June, 1939, *Davis 1046* (R); Mt. Hyndman, Blaine Co., July, 1936, *Thompson 13637* (G, R, T); near Clyde, Blaine Co., July, 1916, *Macbride & Payson 3137* (G, RM, US); Parker Mt., Custer Co., July, 1916, *Macbride & Payson 3257* (G); 7 miles north of Dickey, Custer Co., June, 1938, *Hitchcock 3796* (R); Caribou Mt., Bonneville Co., July, 1923, *Payson & Armstrong 3565* (G, P). UTAH: Henry's Fork Basin, Summit Co., Aug., 1936, *Maguire et al. 14688* (G, R, UAC); Gunsight Pass, Summit Co., *Maguire et al. 14564* (G, R, UAC); La Motte Peak, Uinta Mountains, July, 1926, *E. B. & L. B. Payson 5091* (M, RM); Mt. Agassiz, Duchesne Co., Aug., 1933, *Maguire et al. 4144* (UAC); Black Mt., near Salt Lake City, May, 1903, *Mrs. Joseph Clemens s.n.* (G); Cottonwood Canyon, May, 1932, *Burke 2977* (UAC). NEVADA: alpine peak east of Mt. Wheeler, Snake Range, White Pine Co., July, 1938, *Rollins & Chambers 2477* (G, R); Jarbidge, July, 1912, *Nelson & Macbride 1971* (G); above Liberty Pass, Ruby Mts., about 16 miles southeast of Lamoille, Elko Co., July, 1938, *Rollins & Chambers 2554* (G, R); Duck Creek near Ely, Aug., 1913, *A. E. Hitchcock 1411* (US); Clover Mts., Sept., 1868, *S. Watson 71* (G, TYPE of *A. canescens*, var. *latifolia*); Toiyabe Dome, Toiyabe Mts., Aug., 1939, *Hitchcock & Martin 5623* (R); Galena Creek, Washoe Co., Aug., 1906, *Kennedy 1248* (US, TYPE; NY, isotype of *A. Kennedyi* Greene); Mt. Rose, Washoe Co., Aug., 1938, *J. T. Howell 14215* (G, R). CALIFORNIA: Lassen Peak, Sept., 1872, *J. G. Lemmon 23* (G, TYPE), Aug., 1882, *Mrs. R. M. Austin s.n.* (G, UC); White Mt., Conness Range, Tuolumne Co., July, 1936, *Mason 11326* (G, UC); Kaiser Peak, Fresno Co., July, 1914, *Smiley 644* (G); Mt. Warren Pass, Mono Co., Aug., 1894, *Congdon 613* (G, UC); Virginia Lakes Basin, Mono Co., July, 1934, *Peirson 11331* (Peirs); Rock Creek Lake Basin, Inyo Co., July, 1934, *Peirson 11296* (Peirs); Farewell Gap, Tulare Co., 1897, *C. A. Purpus 5229* (US, TYPE; G, UC, isotypes of *A. polyclada*), Aug., 1891, *Coville & Funston 1747* (G). OREGON: Wallowa Mts., Baker Co., July, 1936, *Thompson 13399* (R, T), July, 1899,

Cusick 2264 (G, UC, US, WSC); near Wallowa Lake, Wallowa Co., July, 1936, *L. S. Rose 36610* (R); Mt. Thielson, Klamath Co., Aug., 1897, *Coville & Applegate 454* (US, TYPE; RM, isotype of *A. semisepulta*); Mt. Scott, Crater Lake, July, 1935, *Thompson 12280* (T, UW), Sept., 1902, *Coville 1489* (US). WASHINGTON: Mt. Stuart, Chelan Co., July, 1931, *Thompson 7700* in part (G, UC); Three Brothers Peak, Chelan Co., June, 1934, *Thompson 10582* (T); Mt. Adams, Aug., 1906, *Suksdorf 1920* (G, R, UC, US, WSC), Aug., 1885, *Suksdorf 510* (G); Mt. Angeles, Clallam Co., June, 1932, *Thompson 8393* (G), July, 1933, *Thompson 9465* (NY). BRITISH COLUMBIA: Beaverfoot Mts., Selkirk and Rky. Mts., July, 1904, *C. H. Shaw 315* (US, TYPE; G, isotype of *A. oreocallis*); Bow River Pass, Sept., 1879, *Macoun 74* (G); Silver City, Aug., 1885, *J. Macoun s.n.* (G); summit of Rky. Mts., Aug., 1890, *J. Macoun s.n.* (G); Bluster Mt., Marble Mts., July, 1938, *J. & E. Thompson 457* (G); Chipuin Mt., Marble Mts., July, 1938, *J. & E. Thompson 627* (G).

18b. Var. **paddoensis,** var. nov. Herba glabra vel sparse pubescens; caulibus 1–2.5 dm. altis; foliis radicalibus sparse pubescentibus vel glabris spathulatis vel oblanceolatis. MAP 10. WASHINGTON: Mt. Stuart region, Kittitas Co., 1931, *Thompson 7753½* (G); high alpine ridges at head of Beverly Creek, Kittitas Co., July, 1933, *Thompson 9500* (G, T); east of Mt. Adams, Aug., 1892, *Henderson 2391* (G, UW); rocks, Mt. Adams (Paddo), Aug., 1885, *Suksdorf 509* (G, TYPE), Sept., 1905, *Suksdorf 5296* (G).

18c. Var. **drepanoloba** (Greene) comb. nov. Stems few, 1.5–4 dm. high; pubescence of basal leaves coarser and less dense than in var. *typica;* siliques 3–5 cm. long, 2.5–3.5 mm. wide.—*A. drepanoloba* Greene in Pitt. **3:** 306 (1898); Rydberg, Fl. Rky. Mts. 360 (1918).—Alberta to Wyoming. MAP 11. ALBERTA: Crow Nest Pass, Aug., 1897, *Macoun 18114* (G); Devil's Head Lake, Banff, Aug., 1891, *Macoun 1719a* (ND, TYPE; US, isotype; photo of type in Gray Herb.); Bertha Lake, vicinity of Waterton Lakes, July, 1938, *Hunnewell 15825* (G). MONTANA: Glacier Nat. Park, July, 1933, *C. L. Hitchcock 2043* (G, P), July, 1919, *Standley 15796* (US). WYOMING: Gros Ventre Mts., Sublette Co., Aug., 1922, *E. B. & L. B. Payson 3039* (G, M, P, RM, US); near Alpine, Lincoln Co., July, 1923, *Payson & Armstrong 3463* (G, M, RM); northeast of Smoot, Lincoln Co., July, 1923, *Payson & Armstrong 3637* (G, M, RM).

18d. Var. DEPAUPERATA (Nelson & Kennedy) Rollins. Basal leaves narrowly oblanceolate, very finely pubescent; cauline leaves densely pubescent; pedicels and siliques divaricately ascending.—Madroño **3:** 360 (1936). *A. depauperata* Nelson & Kennedy in Proc. Biol. Soc. Wash. **19:** 36 (1906).—Nevada

and California. Map 11. Nevada: Bunker Hill, Toiyabe Forest, July, 1913, *A. E. Hitchcock 855 & 866* (US); Toiyabe Dome, Toiyabe Mts., Nye Co., July, 1938, *Rollins & Chambers 2522* (G, R); Mt. Rose, Washoe Co., Aug., 1905, *Kennedy 1167* (RM, type; UC, isotype), July, 1909, *Heller 9868* (NY, US), July, 1939, *Hitchcock & Martin 5497* (R). California: Tinkers Knob, Placer Co., July, 1897, *S. F. Sonne s.n.* (P, UC); Mt. Tallac, Eldorado Co., July, 1903, *Hall & Chandler 4624* (UC); Rubicon Peak, Eldorado Co., Aug., 1913, *Smiley 405* (G); near Crest View, 19 miles south of Mono Lake, Aug., 1938, *Constance 2462* (R); Olancha Mt., Tulare Co., June, 1904, *Hall & Babcock 5229* (G).

Watson first listed plants of *A. Lemmoni* both as *A. canescens* and as *A. canescens,* var. *latifolia,* but an accumulation of specimens from the high mountains of several western states led him to separate them later as a distinct species. Of the several specimens cited with the original description, one from Lassen Peak, California, by J. G. Lemmon must be regarded as the type. *A. Lemmoni* is found on the highest peaks in many of the main ranges of western America. Its range is necessarily disrupted due to the lack of tolerable habitats between the high peaks, many of which have undoubtedly been isolated for a considerable period. This probably contributes to the fact that *A. Lemmoni* exhibits a number of minor variations in its morphology when plants from the entire geographic range are considered. As shown by the list of synonyms, a number of independent specific names have been proposed for the various phases of this species. Most of these were proposed without due regard for the usual variations found in even a single colony of *A. Lemmoni.*

Three varieties are distinctive and have been set off to indicate the directions in which particular specialization is apparently taking place in the species. These varieties share with var. *typica* only a fragment of the total range of the species and differ from each other and the typical variety in several ways. Var. *depauperata* has divaricately ascending siliques which are rarely secund instead of the horizontally spreading to slightly reflexed secund siliques of the other varieties. It is more pubescent above, has narrower, longer siliques and narrower basal leaves than var. *typica.* Var. *drepanoloba* is larger in stature with broader siliques and a more scanty, slightly coarser pubes-

cence than is found in the typical variety. Var. *paddoensis* is restricted to the Cascade Range in central and southern Washington and differs from the typical variety in being wholly glabrous or only scantily pubescent.

19. A. OXYLOBULA Greene. Caespitose perennial; caudex simple or branching, densely covered with old leaf-bases; stems slender, numerous, simple, glabrous, 8–12 cm. high; basal leaves linear to narrowly oblanceolate, entire, acute, glabrous or the petioles sparingly hirsute with simple trichomes, 2–3 cm. long, 3–5 mm. wide; cauline leaves few, oblong, remote, entire or minutely denticulate, glabrous, teeth and apex often cuspidate, sessile, not auriculate, 8–15 mm. long; inflorescence few-flowered, loose; sepals glabrous, oblong, 2–3 mm. long, about 1 mm. wide; petals lingulate to spatulate, pink, about 5 mm. long, 1.5–2 mm. wide; glands poorly developed; pedicels filiform, glabrous, arched or horizontal, 3–6 mm. long; siliques glabrous, widely pendulous to spreading almost at right angles, nerved to the middle or above, 1.5–2.5 cm. long, 1.5–2 mm. wide; seeds orbicular, winged all around, about 1 mm. wide, uniseriate.—Pittonia **4**: 195 (1900); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909) in part; Rydberg, Fl. Rky. Mts. 361 (1918).—COLORADO: Glenwood Springs, Garfield Co., June, 18, 1899, *G. E. Osterhout s.n.* (ND, TYPE; photo in Gray Herb.), June 6, 1902, *Osterhout 2575* (NY, RM).

Unfortunately too little material is available of this species. It is related to *A. demissa*, but differs in having broader cauline leaves, basal leaves with thinner texture, and more numerous filiform stems. Also the siliques of *A. oxylobula* are shorter, more acute and more widely spreading than those of *A. demissa*. The present disposition of *A. oxylobula* is frankly provisional. A larger suite of specimens may show an intergradation with *A. demissa* in which case it would be better treated as a variety.

20. A. DEMISSA Greene. Perennial, caespitose; stems several to numerous from a simple or branching caudex, simple or rarely branched above, slender, hirsute below or glabrous throughout, 1–3 dm. high; basal leaves linear to oblanceolate, acute or the outer obtuse, entire, hirsute with large simple or forked trichomes or rarely nearly glabrous, margins usually ciliate, 1.5–3.5 cm. long, 2–5 mm. wide; cauline leaves remote, sessile, not auriculate except in var. *languida*, 5–10 mm. long, 1.5–4 mm. wide, lower usually sparsely hirsute, upper glabrous; sepals oblong, sparsely pubescent, non-saccate, 2–3.5 mm. long, about 1.5 mm. broad; petals white to pink, spatulate, 4.5–6.5 mm.

long, 1.5–2 mm. broad; nectar-glands developed around single stamens, merely subtending paired stamens; pedicels glabrous, slender, arched downward, 3–7 mm. long; siliques pendulous, nerved about to the middle, 2–4 cm. long, 1.5–2 mm. wide, valves often constricted between seeds; stigma sessile; seeds orbicular to slightly oblong, plump, narrowly winged or wingless, about 1 mm. broad, uniseriate.

KEY TO THE VARIETIES OF A. DEMISSA

a. Basal leaves linear to narrowly oblanceolate; cauline leaves without auricles.....b.
  b. Trichomes on leaves and stems simple; basal portion of stems sparsely hirsute or the stems completely glabrous; valves of siliques not constricted between seeds; seeds wingless; southern Wyoming and northeastern Utah.....20b. Var. *russeola*.
  b. Trichomes on leaf-blades forked and smaller than those of the margins; basal portion of stems hirsute with forked trichomes; valves of siliques constricted between seeds; seeds narrowly winged to wingless; Colorado.....20a. Var. *typica*.
a. Outer basal leaves oblanceolate; cauline leaves auriculate; southern Wyoming and northeastern Utah.....20c. Var. *languida*.

20a. Var. **typica.** *A. demissa* Greene, Pl. Baker. **3:** 8 (1901). *A. rugocarpa* Osterhout in Bull. Torr. Bot. Club **31:** 357 (1904); Coulter & Nelson, New Man. Bot. Rky. Mts. 227 (1909); Rydberg, Fl. Rky. Mts. 361 (1918). *A. aprica* Osterhout ex Nelson in Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909).—MAP 8. COLORADO: Sulphur Springs, Grand Co., June, 1907, *Osterhout 3540* (RM, TYPE; NY, isotype of *A. aprica*); Malta Station, near Leadville, Lake Co., June, 1903, *Osterhout 2800* (RM, TYPE; NY, isotype of *A. rugocarpa*); June, 1900, *Osterhout 2096* (NY); Phipps Ranch, Mineral Co., May, 1911, *J. Murdoch Jr. 4511* (M, NY, US); near Sargents, Saguache Co., May, 1938, *Rollins 2086* (G, R); June, 1928, *Osterhout 6920* (M); 4 miles east of Gunnison, May, 1938, *Rollins 2099* (G, R); 1 mile east of Sapinero, May, 1938, *Rollins 2113* (G, R); 5 miles south of Iola, Gunnison Co., Sept., 1937, *Rollins 2002* (G, R); in a stony river bed, Cimarron, Gunnison Co., 1901, *C. F. Baker 16* (ND, TYPE; photo in Gray Herb.).

20b. Var. **russeola,** var. nov. Herba caespitosa; caulibus glabris vel inferne pilosis, 1–2.5 dm. altis; foliis radicalibus hirsutis; caulinis remotis non auriculatis; petalis albis; seminibus orbicularibus exalatis uniseriatis.—Wyoming and Utah. WYOMING: Laramie Hills, Albany Co., June, 1899, *E. Nelson 212* (G, NY). UTAH: vicinity of Flaming Gorge, Daggett Co., June, 1938, *Rollins 2272* (G, R), May, 1932, *L. Williams 459* (G, NY, RM); 18 miles north of Vernal, Uintah Co., June, 1937, *Rollins 1757* (G, TYPE; R, isotype).

20c. Var. **languida,** var. nov. Herba multicaulis caespitosa; caulibus simplicibus vel superne ramosis 1–3 dm. altis; foliis radicalibus hirsutis; caulinis auriculatis; pedicellis 4–7 mm. longis; seminibus orbicularibus exalatis vel anguste alatis uniseriatis 1 mm. latis.—Wyoming and Utah. Map 8. Wyoming: Albany Co., Laramie Hills, May, 1896, *A. Nelson 1885* (NY, P, US); near City Springs, east of Laramie, June 14, 1936, *Rollins 1178* (G, type; R, isotype), June, 1935, *L. Williams 2183* (G, M), June, 1937, *Rollins 1610* (G, R); 2 miles southeast of Green River, Sweetwater Co., June, 1938, *Rollins 2250* (G, R). Utah: 15 miles southeast of Manila, near Flaming Gorge, Daggett Co., June, 1938, *Rollins 2279* (G, R).

Typical *A. demissa* is very abundant on exposed stony knolls in the Gunnison Basin of western Colorado. The plants are often associated with dwarfed sagebrush and in some small areas devoid of shrubby types it becomes the dominant species. The type specimen of *A. demissa* collected in a "stony river bed", which is an unnatural habitat for the species, is nearly glabrous, only the petioles of the basal leaves being hirsute. Usually, the young basal leaves are conspicuously hirsute with large simple or forked trichomes, but much of the indument is shed as the leaves mature. Often plants are found with the outer basal leaves completely glabrous, while the inner are densely hirsute.

A. demissa is nearest related to *A. Fendleri,* var. *spatifolia,* from which it differs in being caespitose with numerous stems instead of being one- to few-stemmed, in having larger seeds which are disposed in a single row rather than a double row, and small, remote cauline leaves in place of relatively large, imbricated ones. *A. demissa,* var. *typica* has the valves markedly constricted between the seeds, but this character is not found in vars. *russeola* and *languida* in which the valves are plane. Var. *languida* has auriculate cauline leaves, whereas in vars. *typica* and *russeola* the cauline leaves lack auricles.

21. A. pendulina Greene. Perennial; stems several to numerous from a simple caudex, hirsute with simple trichomes below to glabrous throughout, simple or rarely branched above, usually slender, 1–4 dm. high; basal leaves spatulate to linear-oblanceolate, entire, hirsute with simple trichomes to glabrous, 1–4 cm. long, 3–10 mm. wide, petioles slender; cauline sessile, usually non-auriculate, lanceolate to slightly broader, acute, glabrous

or the lower hirsute, 5–10 mm. long, 2–6 mm. wide; inflorescence few-flowered, lax; pedicels slender, arched downward, glabrous, 5–10 mm. long; sepals oblong, glabrous or hirsute with a few large trichomes, usually purplish, non-saccate, 3-4 mm. long; petals pink to purplish, spatulate, 5–6 mm. long, about 2 mm. broad; glandular tissue continuous under both single and paired stamens, poorly developed; siliques glabrous, pendulous, straight to slightly curved, obtuse, nerved below, 2–4 cm. long, 2–3 mm. broad; stigma sessile; seeds biseriate, slightly oblong, wingless, about 1 mm. broad.—Leaflets **2:** 81 (1910); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 245 (1925). *A. setulosa* Greene, Leaflets **2:** 81 (1910). *A. Diehlii* M. E. Jones, Contrib. West. Bot. **14:** 38 (1912). *A. nevadensis* Tidestrom in Proc. Biol. Soc. Wash. **36:** 182 (1923).—Utah and Nevada. Map 11. Utah: Marysvale, June, 1894, *M. E. Jones 5330* (US, type; NY, P, UC, isotypes of *A. setulosa*); Joe's Valley, Emery Co., May, 1932, *Pickford & Pechanec 139* (FS); Cedar Ridge, Sevier Co., May, 1923, *Miller 246* (FS). Nevada: near Lehman Creek, east of Mt. Wheeler, Snake Range, White Pine Co., July, 1938, *Rollins & Chambers 2469* (G, R), June, 1927, *Gray 155* (FS); Charleston Mts., Clark Co., May–Oct., 1898, *C. A. Purpus 6104* (US, type; UC, isotype); Clark Canyon, Charleston Mts., June, 1936, *Clokey 7125* (G, R); head of Lee Canyon, Charleston Mts., Aug., 1913, *Heller 11077* (US, type; G, NY, UC, isotypes of *A. nevadensis*); Deer Creek, Charleston Mts., June, 1939, *Alexander 743c* (G, UC); Hidden Forest, Sheep Mts., Clark Co., May, 1940, *Alexander & Kellogg 1520* (R).

Arabis pendulina is closely related to *A. Fendleri*, but differs in having smaller, usually entire basal leaves, numerous slender stems, small, remote, usually non-clasping cauline leaves and shorter siliques. The plants are more tufted and never attain the robustness found in *A. Fendleri*. There is also a difference in the type of pubescence exhibited on the basal leaves of the two species. In *A. pendulina*, the pubescence is predominantly simple on the leaf-surfaces and margins, whereas in *A. Fendleri* the pubescence is commonly forked, especially on the leaf-surfaces.

The glabrous phase of *A. pendulina* was named *A. nevadensis* by Tidestrom, but this, as in other species of *Arabis*, is a feature often found in plants growing at high altitudes. All stages between glabrous and hirsute types have been repeatedly observed. *A. setulosa* Greene and *A. Diehlii* Jones were based on plants collected in the mountains near Marysvale, Utah.

FIG. 1. A. DEMISSA drawn from *Rollins 2113;* FIG. 2. A. KOEHLERI drawn from *Cusick 2905;* FIG. 3. A. GUNNISONIANA drawn from *Rollins 2090;* FIG. 4. A. CRUCISETOSA drawn from *Rollins, Contance & Dillon 1107.*

B. Diagram of the glandular tissue on the receptacle; C. Sepal about two times natural size; D. Petal about two times natural size; E. Stamen about two times natural size. All figures about one-half natural size except figures 4B, 4C, 4D, and 4E.

It is not certain that the same species was described in each case because I have been unable to locate the type of *A. Diehlii* in Jones's herbarium at Pomona College, but the two descriptions are very similar. Certainly *A. setulosa* does not fall outside the natural specific variation found in *A. pendulina*.

22. A. RECTISSIMA Greene. Biennial; stems one to several from a simple or rarely branched caudex, often purplish, simple to branched above, sometimes rather stout, glabrous to sparsely hirsute below with coarse, simple trichomes, 2–8 dm. high; basal leaves numerous, spatulate to oblanceolate, short-petioled, entire, hirsute with coarse simple and forked trichomes, 1–3 cm. long, 4–10 mm. wide, blade-surfaces sometimes glabrous, margins always ciliate; cauline leaves crowded below, remote above, oblong to nearly lanceolate, obtuse, auriculate or the auricles nearly wanting, sessile, ciliate, sparsely hirsute or the upper glabrous, 1–2 cm. long, 3–8 mm. wide; sepals oblong, obtuse, sparsely hirsute near apex, 2–3 mm. long; petals spatulate to narrowly lingulate, white or rarely pinkish, 4–6 mm. long, 1–2 mm. wide; glandular tissue well developed in a continuous ring beneath all stamens; fruiting raceme 1–4 dm. long; pedicels glabrous, strictly reflexed, 4–12 mm. long; siliques numerous, crowded, straight, strictly reflexed, appressed to the rachis, glabrous, 1-nerved below, acute at apex, 5–8 cm. long, 1.5–2.5 mm. wide; stigma sessile or nearly so; seeds orbicular, winged all around, about 1.5 mm. broad, uniseriate.—Pittonia **4:** 191 (1900); Jepson, Fl. Calif. **2:** 68 (1936); Rollins in Madroño **3:** 362 (1936) and in Res. Stud. State Coll. Wash. **4:** 30 (1936); Applegate in Am. Midl. Natur. **22:** 269 (1939). *A. setigera* Greene, Leaflets **2:** 80 (1910). *A. Holboellii*, var. *Fendleri* sensu Jepson, Man. Fl. Pl. Calif. 429 (1925). *A. Wyndii* Henderson in RHODORA **32:** 25 (1930).—Western Nevada, California and southern Oregon. MAP 12. NEVADA: Creek at Incline, Lake Tahoe, Washoe Co., Aug., 1938, *Archer 6695* (NA). CALIFORNIA: near Black Butte, north of Sisson, Siskiyou Co., June, 1916, *Heller 12421* (Cl, G, M, Ph, US, WSC); Mt. Shasta, July, 1912, *Eastwood 1231* (G); Diamond Mt., Lassen Co., June, 1897, *M. E. Jones s.n.* in part (P); Prattville, Plumas Co., July, 1907, *Heller & Kennedy 8809* (G, P, UC, US); Jonesville, Butte Co., July, 1929, *Copeland 367* (G, NY, US); Downieville, Sierra Co., May, 1854, *J. M. Bigelow s.n.* (G); Rubicon Park, Eldorado Co., July, 1901, *Setchell & Dobie s.n.* (UC); Cascade Creek, western Yosemite Nat. Park, Tuolumne Co., July, 1934, *Hodgdon & Rossbach 5* (G); Sunrise Trail, Yosemite Nat. Park, Mariposa Co., July, 1936, *H. K. Sharsmith 3808* (R); 1 mile northwest of Ellis Meadow, Madera Co., July, 1938, *Constance 2393* (R); Dinkey

Creek, Fresno Co., June, 1900, *Hall & Chandler 346* (UC); Fresno Co., 1890, *Mrs. Peckinpah s.n.* (ND, TYPE; NY, isotype); Olancha Mt., Tulare Co., June, 1904, *Hall & Babcock 5290* (UC); north side of Bear Lake, San Bernardino Mts., June, 1922, *Munz 5729* (P); City Creek Grade, San Bernardino Mts., June, 1926, *M. E. Jones s.n.* (P). OREGON: Corral Springs, Klamath Co., Aug. 2, 1894, *Leiberg 610* (US, TYPE; G, O, UC, isotypes of *A. setigera*); Cherry Cr., Klamath Co., July, 1899, *Leiberg 4305* (O, US); 5 miles north of Fort Klamath, July, 1920, *Peck 9564* (G, M, W, WSC); Crater Lake, July, 1928, *Wynd 2322* (O, TYPE of *A. Wyndii*).

The pubescence of *A. rectissima* is similar to that of *A. Fendleri* and *A. pendulina*. Instead of the widely spreading pedicels and curved pendulous siliques found in those species, *A. rectissima* has strictly reflexed pedicels and straight siliques. A unique feature of this species is the long fruiting raceme which often occupies over half the entire length of the stem. *A. rectissima* has often been confused with varieties of *A. Holboellii*, but plants of these species are not as closely related as historical treatments would seem to indicate. The large acicular trichomes fringing the basal leaf-blades in *A. rectissima* are a quick mark of identity.

Beginning in the southern Cascade Mountains of Oregon, *A. rectissima* is found at middle elevations almost continuously along the Sierra Nevada mountain-axis to Tulare County, then, like many other plants of similar distribution, it jumps to the San Bernardino Mountains where its geographical area is relatively limited.

23. A. FENDLERI (Watson) Greene. Perennial; stems one to several from a simple caudex, simple or branched above, hirsute below with simple, spreading trichomes, glabrous above, 2.5–6 dm. high; basal leaves oblanceolate to linear-oblanceolate, entire to coarsely dentate, densely pubescent with coarse, simple or forked trichomes or the surfaces nearly glabrous, margins ciliate, 2–6 cm. long, (2–) 3–15 mm. broad; cauline leaves sessile, oblong to lanceolate, auriculate, lower pubescent and usually imbricated, upper glabrate, entire or rarely dentate, 1–4 cm. long, 2–8 mm. broad; pedicels slender, ascending at anthesis, arched downward in fruit, glabrous, 1–2 cm. long; sepals glabrous or usually with a few trichomes, oblong, 3–5 mm. long, 1.5–2 mm. broad; petals spatulate, white to pink, 5–8 mm. long, 2–3 mm. broad; nectar-glands subtending single stamens, poorly developed be-

low paired stamens; siliques glabrous, pendulous, nerved to the middle or slightly above, obtuse, 3–6 cm. long, 1.5–2.5 mm. wide; stigma sessile; seeds orbicular to slightly oblong, narrowly winged or rarely almost wingless, 1–1.5 mm. broad, biseriate.

Basal leaves dentate, oblanceolate, obtuse; petals pink....23a. Var. *typica.*
Basal leaves entire, linear-oblanceolate, acute; petals white
23b. Var. *spatifolia.*

23a. Var. **typica.** *A. Fendleri* (Watson) Greene, Pitt. **3:** 156 (1897); Rydberg, Fl. Colo. 165 (1906); Coulter & Nelson, New Man. Rky. Mts. 229 (1909); Wooton & Standley in Contrib. U. S. Nat. Herb. **19:** 280 (1915) in part; Rydberg, Fl. Rky. Mts. 362 (1918) in part. *A. Holboellii* Hornem., var. *Fendleri* Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895). *A. porphyrea* Wooton & Standley in Contrib. U. S. Nat. Herb. **16:** 123 (1913), ibid. **19:** 280 (1915).—Colorado to Texas, northern Mexico and Nevada. Map 12.[1] Colorado: Wolhurst, Douglas Co., May, 1920, *Clokey 3785* (Cl, G, P); La Veta Pass, Costilla Co., June, 1936, *Rollins 1288* (R); 4 miles east of Gunnison, Gunnison Co., May, 1938, *Rollins 2098* (G, R). New Mexico: without locality, 1847, *A. Fendler 27* (G, type; NY, isotype; a sheet of this number at the Missouri Botanical Garden is a mixture of *A. Fendleri* and *A. perennans*); near Santa Fe, May, 1897, *A. A. & E. Heller 3562* (M; other specimens of this collection are *A. perennans*); South Percha Creek, Sierra Co., May, 1905, *Metcalfe 1591* (M); Silver City, April, 1919, *Eastwood 8219* (Cl, G); Sandia Mts., near Albuquerque, June, 1926, *E. J. Palmer 31202* (M), April, 1911, *Ellis 9* (M, NY); Tierra Amarilla, Arriba Co., April-May, 1911, *Eggleston 6446* (G, M, US); at the Cueva, Organ Mts., Dona Ana Co., April, 1907, *Wooton & Standley s.n.* (US, type of *A. porphyrea*). Texas: Hueco Mts., El Paso Co., March, 1932, *Whitehouse 8307* (F); Sierra Blanca, April, 1930, *M. E. Jones 25824* (M); Alpine, Brewster Co., April, 1919, *Hanson 640* (M, NY). Utah: Silver Reef, May, 1894, *M. E. Jones 5176f* in part (P); Pine Valley, Washington Co., June, 1933, *Eastwood & Howell 1270* (G). Nevada: south end of Bristol Range, 10 miles northwest of Pioche, Lincoln Co., April, 1939, *Train 2664* (NA, R); Charleston Park, Clark Co., June, 1937, *Clokey 7538* (Cl, G, R), May, 1936, *Clokey 7121* (Cl, R); Griffith's Lodge, Charleston Mts., June, 1936, *Clokey 7119* (Cl, R). Arizona: Grand Canyon, June, 1916, *Eastwood 5778* (G); Kaibab, June, 1929, *M. E. Jones s.n.* (P); North Rim, Grand Canyon, June, 1933, *Eastwood & Howell 961* (G); near Flagstaff, May, 1898, *MacDougal 6* (G); 6 miles east of Flagstaff, Coconino Co., July,

[1] The symbols for vars. *typica* and *spatifolia* were inadvertently reversed in the legend of this map. The triangles indicate the range of var. *typica;* the solid circles, the range of var. *spatifolia.*

1938, *Rollins & Chambers 2811* (G). Mexico: (Lake Santa Maria) Chihuahua, 1852, *C. Wright 1313* (G).

23b. Var. **spatifolia** (Rydberg), comb. nov. Stems one or few, usually branched above, 2–5 dm. high; basal leaves linear-oblanceolate, acute, 1.5–2.5 cm. long, 2–4 mm. wide; petals white, 5–6 mm. long; siliques about 2 mm. wide.—*A. spatifolia* Rydberg, Fl. Rky. Mts. 361 (1918). *A. Fendleri* sensu Rydberg, Fl. Pr. Pl. Cent. N. Am. 382 (1932) in part.—Southern Wyoming to northern New Mexico and eastern Utah. Map 12. Wyoming: Ragged Top, 25 miles north of Laramie, July, 1938, *Beetle 5591* (G, R); Dale Creek, Albany Co., June 30, 1896, *E. L. Greene s.n.* (ND); 3 miles south of Lonetree, Uinta Co., June, 1938, *Rollins 2303* (G, R). Colorado: Estes Park, Larimer Co., July, 1903, *Osterhout 2808* (NY, type; RM, isotype), June, 1916, *E. L. Johnston 90B* (G, NY, US); 4 miles west of Estes Park, Rocky Mountain National Park, June, 1938, *Rollins & Chambers 2399* (G, R); near Central City, Gilpin Co., July, 1937, *Beetle 2047* (R); Brookvale, Clear Creek Co., July, 1937, *Beetle 2065* (R); near Cripple Creek, Teller Co., Aug., 1937, *Beetle 2245* (R); Pikes Peak, June, 1935, *Ownbey 711* (R); east of Leadville, Lake Co., July, 1936, *Rollins 1349a* (R); Royal Gorge Bridge, Fremont Co., May, 1938, *Rollins 2069* (G, R); 4 miles south of Salida, Chaffee Co., May, 1938, *Rollins 2077* (G, R); Devils Hole, Huerfano Co., June, 1936, *Rollins 1254* (G, R). New Mexico: Ute Park, Colfax Co., Aug., 1916, *Standley 13619* (NY); Tres Piedras, Taos Co., June, 1930, *Talbot 1318* (NA). Utah: near Sheep Creek, 12 miles southwest of Manila, Daggett Co., June, 1938, *Rollins 2266* (G, R).

Arabis Fendleri has a very distinctive setaceous, simple or forked pubescence which makes it readily separable from the related *A. perennans*, with which it has often been confused. The latter has smaller trichomes of a dendritic type evenly covering the blade-surfaces of the basal leaves. The leaf-margins are usually ciliate in *A. Fendleri*, but this is never the case with *A. perennans*. The nearest relative of *A. Fendleri* is *A. pendulina*. This relationship has been discussed under the latter species.

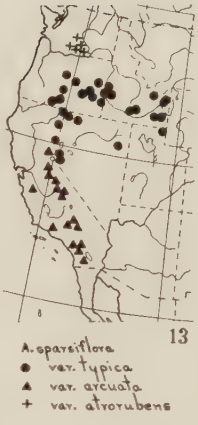
Typical *A. Fendleri* is quite variable compared to var. *spatifolia*, which shows unusual uniformity throughout its range. Perhaps some of the variability found in var. *typica* is to be associated with polyploidy which is apparently more marked here than in var. *spatifolia*. A hexaploid form of var. *typica* growing in Costilla County, Colorado, is exceedingly robust, but is not otherwise distinctive. Contrariwise, a tetraploid plant of

var. *spatifolia* from Gunnison County, Colorado, did not show a similar robustness. Rather, it seemed to be the same as diploid plants of the variety collected elsewhere in Colorado.

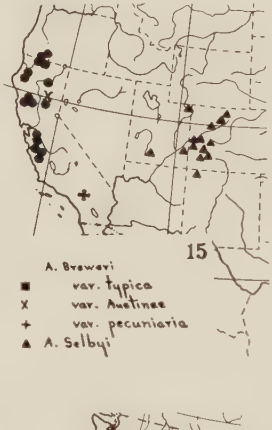
24. A. PERENNANS Watson. Perennial; stems several to numerous from a simple or branching ligneous caudex, simple or branched above, pubescent below with coarse, dendritic, usually spreading trichomes, glabrate above, 1.5–6 dm. high; caudex often elongated; basal leaves numerous, oblanceolate to broader, petiolate, dentate or rarely entire, densely pubescent with fairly coarse dendritic trichomes, 2–6 cm. long, 4–20 mm. wide; cauline leaves lanceolate, auricled and somewhat sagittate, entire or rarely sparsely dentate, 1–3 cm. long, 2–8 mm. wide, lower pubescent, upper glabrous; sepals oblong, nonsaccate, pubescent, 3.5–4.5 mm. long, 1–1.5 mm. wide; petals spatulate with a narrowed claw, purple to pinkish, 6–9 mm. long, 1.5–2.5 mm. wide; pedicels very slender, spreading and arched downward, glabrous, 1–2 cm. long; siliques widely spreading to pendulous, glabrous, curved inward, nerved at base or usually nerveless, 4–6 cm. long, 1.2–2 mm. wide; stigma sessile; seeds orbicular, winged all around, 1–1.5 mm. broad, uniseriate.—Proc. Am. Acad. **22**: 467 (1887) and in Gray, Syn. Fl. N. Am. **1**: 165 (1895); Coville in Contrib. U. S. Nat. Herb. **4**: 61 (1893); Rydberg, Fl. Rky. Mts. 360 (1918) in part; Jepson, Man. Fl. Pl. Calif. 431 (1925) and Fl. Calif. **2**: 70 (1936), excluding var. *longipes;* Tidestrom in Contrib. U. S. Nat. Herb. **25**: 244 (1925); Munz, Man. So. Calif. Bot. 204 (1935). *A. arcuata*, var. *perennans* (Watson) M. E. Jones in Proc. Calif. Acad. Sci. **5**: 621 (1895). *A. gracilenta* Greene in Pittonia **4**: 194 (1900); Rydberg, Fl. Rky. Mts. 362 (1918) in part. *A. eremophila* Greene in Pittonia **4**: 194 (1900); Coulter & Nelson, New Man. Rky. Mts. 227 (1909) in part; Rydberg, op. cit. p. 361 in part. *A. recondita* Greene in Pittonia **4**: 195 (1900). *A. angulata* Greene ex Wooton & Standley in Contrib. U. S. Nat. Herb. **16**: 123 (1913); Wooton & Standley in Contrib. U. S. Nat. Herb. **19**: 280 (1915). *A. Fendleri* sensu Wooton & Standley, ibid. in part.—Colorado and New Mexico to Nevada, California and Baja California. MAP 3. COLORADO: 2 miles west of Rifle, Garfield Co., May, 1938, *Rollins 2203* (G, R); 4 miles south of Mesa, Mesa Co., May, 1938, *Rollins 2187* (G, R); 3 miles northeast of Cedaredge, Delta Co., May, 1938, *Rollins 2148* (G, R); 10 miles south of Montrose, Montrose Co., May, 1938, *Rollins 2128* (G, R); Naturita, Montrose Co., April, 1914, *Payson 231* in part (G, RM); 10 miles northeast of Ridgeway, Ouray Co., Sept., 1937, *Rollins s.n.* (R). NEW MEXICO: Santa Fe, May, 1897, *A. A. & E. G. Heller 3562* (ND, TYPE; G, isotype of *A. gracilenta.* This number at the Missouri Botanical Garden is

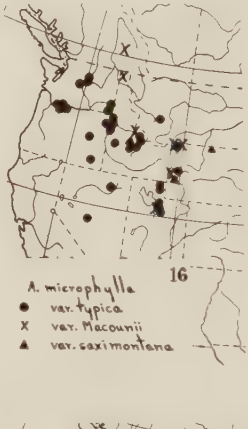

A. Lemmoni
var. depauperata
var. drepanoloba
var. paddoensis
A. pendulina
11

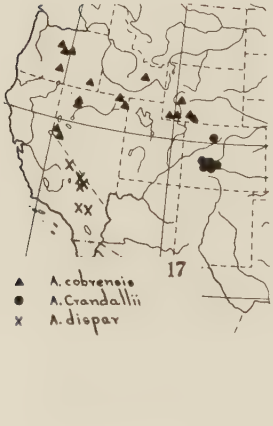

A. Fendleri
var. typica
var. spatifolia
A. rectissima
12


A. sparsiflora
var. typica
var. arcuata
var. atrorubens
13


A. sparsiflora
var. californica
var. subvillosa
14


A. Breweri
var. typica
var. Austinae
var. pecuniaria
A. Selbyi
15


A. microphylla
var. typica
var. Macounii
var. saximontana
16


A. cobrensis
A. Crandallii
A. dispar
17


A. pubervula
A. glaucovalvula
18


A. suffrutescens
var. typica
var. perstylosa
A. pulchra var. gracilis
19

A. Fendleri); Mangas Springs, April, 1903, *Metcalfe 12* (US, TYPE; G, NY, isotypes of *A. angulata*); Mangas Springs, April, 1880, *Rusby 11* (M); east of Lordsburg, 1913, *M. E. Jones 25825* (P). UTAH: near Bluff, San Juan Co., April, 1936, *Maguire 15044* (G, UAC); Wah Wah Pass, west of Milford, Beaver Co., April, 1934, *Hutchings & Stahmann s.n.* (FS); Silver Reef, Washington Co., 1894, *M. E. Jones 5152* (P, RM, UC); Virgin, Washington Co., May, 1923, *C. L. Hitchcock 3027* (G); east of Hurricane, May, 1932, *Maguire & Blood 1396* (G, UAC); Zion National Park, April, 1934, *Maguire & Blood 4818* (UAC); St. George, April, 1880, *M. E. Jones 1650* (P, US). NEVADA: about 10 miles south of Austin, Lander Co., June, 1937, *Goodner & Henning 139* (NA, R); north of Nelson, Clark Co., April, 1919, *Tidestrom 8773* (G); Charleston (Spring) Mts., June, 1926, *Jaeger s.n.* (P); Deadman's Canyon, Sheep Mts., Clark Co., May, 1940, *Alexander & Kellogg 1606* (R). ARIZONA: Bright Angel Point, Grand Canyon, July, 1938, *Rollins & Chambers 2442* (G, R); south rim of the Grand Canyon, May, 1938, *A. & R. Nelson 2791* (G); Diamond Creek Canyon (probably Mohave Co.), 1893, *N. C. Wilson s.n.* (ND, TYPE of *A. recondita;* photo in Gray Herb.); Oatman-Kingman, Mohave Co., March, 1931, *Harrison & Kearney 7600* (P); Peach Springs, Mohave Co., April, 1893, *N. C. Wilson s.n.* (ND, TYPE of *A. eremophila*; photo in Gray Herb.); Mt. Ord, Apache Co., May, 1935, *Peebles & Smith 11526* (Sac); south of Safford, Graham Co., March, 1935, *Maguire et al. 10156* (R, UAC); Batatakin, Navajo Co., *Wetherill 346* (US); 1 mile south of Seneca Creek, Globe-Showlow, Gila Co., April, 1938, *Foster & Arnold 271* (G); Superstition Mts., Pinal Co., Feb., 1932, *Gillespie 8790* (G); below Coolidge Dam, Pinal Co., April, 1935, *Maguire 10441* (UAC); Sierra Estrella, Maricopa Co., March, 1935, *Peebles & Smith 10726* (G); Santa Catalina Mts., Pima Co., April, 1881, *Pringle s.n.* (G, TYPE; M, isotype), March, 1926, *Peebles, Harrison & Kearney 1435* (Sac); Tucson, Pima Co., March, 1919, *Eastwood 8120* (G). CALIFORNIA: Panamint Mts., April, 1891, *Coville & Funston 611* (G), June, 1928, *J. T. Howell 2903* (G); north slope of the San Bernardino Mts., May, 1882, *S. B. & W. F. Parish 1301* (G); near Goffs, San Bernardino Co., April, 1928, *Ferris 7263* (P); Providence Mts., May, 1920, *Munz et al. 4256* (P, Peirs, RM, UC); 4th of July Canyon, New York Mts., San Bernardino Co., May, 1940, *Alexander & Kellogg 1317* (R); Coyote Canyon, Riverside Co., April, 1902, *Hall 2869* (G); near Tahquitz Camp, east of Palm Springs, Riverside Co., April, 1919, *Peirson 660* (Peirs); Borego Valley, San Diego Co., May, 1929, *Munz & Hitchcock 11358* (P); Laguna Mts., San Diego Co., May, 1925, *Munz 9678* (P). BAJA CALIFORNIA: Tecate,

May, 1925, *Munz 9591* (P); San Pedro Martir, May, 1893, *T. S. Brandegee s.n.* (G).

A. perennans is found principally in an area bordering the Colorado River drainage in the southwestern United States, but the range extends slightly in all directions. Although it has been reported from as far north as the state of Washington,[1] the species is not known from authentic material north of western Colorado. The Vasey collection (*Vasey no. 201* collected in 1889) upon which Piper based his Washington report is so nearly identical with a specimen from San Diego Co., California, made by Orcutt in 1889 that one is led to suspect them to be one and the same collection.[2] In any case, it is almost certain that the Vasey specimen did not come from Washington.

In the southern portion of its range, *A. perennans* usually has broader, more obtuse basal leaves than in the northern portion. Also, there is some variation in the degree of toothing of the basal leaves. Often the inner leaves are entire and in rare instances all the basal leaves lack any evidence of being dentate. The variation in pedicel-length is noticeable, yet all degrees between 1 and 2 cm. may be found in any sizeable collection of the species.

Several names have been proposed for variants of *A. perennans,* but in each case there are no fundamental characters by which they can be consistently separated. Of the synonyms listed, the type of *A. gracilenta* is perhaps more distinctive than any of the others because of the entire basal leaves. However, this character is not significant when a gradual transition from entire to dentate or repand basal leaves is so obvious as in *A. perennans.* The type of *A. angulata* has especially slender and long pedicels but, as in the case of the basal leaves, we are dealing with an organ which normally has a rather wide range of variation. One near relative of *A. perennans* is *A. Fendleri,* which may be distinguished by its small, nearly wingless, biseriate seeds and large acicular trichomes along the margins of the basal leaves. *A. lignifera,* a plant with a very fine, dense pubescence on the leaves and stems, short, abruptly recurved

[1] Piper in Contrib. U. S. Nat. Herb. **11**: 294 (1906).

[2] In the *Cruciferae* one other collection of this series attributed to the state of Washington (*Vasey 192* in 1889) belongs to *Caulanthus simulans* Pays., a species not known north of southern California.

pedicels and entire leaves, is also related. *A. perennans* often develops a ligneous, elongated caudex which elevates the basal leaves from the ground-surface. The plants often grow intermixed with desert shrubs from which they derive mechanical support.

25. A. GRACILIPES Greene. Perennial, usually with a single robust stem from a simple caudex; stem simple or branched above, densely hirsute below with simple or rarely forked trichomes, glabrous above, 6–9 dm. high; basal leaves oblanceolate to slightly narrower, obtuse, dentate, coarsely pubescent with forked trichomes, 4–6 cm. long, 8–15 mm. broad, cauline lanceolate with a sagittate base, 3–5 cm. long, 5–10 mm. wide, lower imbricated, pubescent and dentate, upper hardly overlapping, entire and glabrous; sepals oblong, glabrous or with a few trichomes near apex, non-saccate, 5–6 mm. long, 1.5 mm. wide; petals narrowly lingulate, pink, 8–10 mm. long, about 2 mm. wide, rounded at apex, not effectively differentiated into blade and claw; glandular tissue continuous beneath all stamens, moderately developed; pedicels very slender, glabrous, ascending but often arching downward on the outer portion, 2–4 cm. long; infructescence 3–4 dm. long; siliques pendulous, glabrous, nerved below, 4–8 cm. long, about 2 mm. wide; stigma sessile; ovules biseriate, mature seeds not seen.—Pittonia **4**: 193 (1900). *A. arcuata* (Nutt.) Gray, var. *longipes* Watson in Gray, Syn. Fl. N. Am. **1**: 164 (1895). *A. perennans* Watson, var. *longipes* (Wats.) Jepson, Fl. Calif. **2**: 70 (1936).—MAP 9. ARIZONA: Flagstaff, Coconino Co., May, 1893, *N. C. Wilson s.n.* (ND, TYPE; photo in Gray Herb.); about Mormon Lake, Coconino Co., June, 1898, *MacDougal 60* (G, US); hot, sandy canyons, Williams, Coconino Co., April, 1924, *Nelson 10244* (G, M, RM); Williams to Ashfork, Coconino Co., April, 1930, *Loomis 6928* (Sac); Fort Mohave, April, 1884, *Lemmon 4184* (G, TYPE of *A. arcuata*, var. *longipes*); rim of Pueblo Canyon, Sierra Ancha, Gila Co., May, 1931, *Harrison 7883* (Sac); near Prescott, Yavapai Co., April, 1936, *McLellan & Stitt 815* (Sac); 6 miles west of Prescott, Yavapai Co., April, 1934, *Mrs. F. M. Stone s.n.* (NY).

This species is more closely related to *A. Fendleri* than to *A. perennans*, as has been indicated by the treatments of Jepson[1] and Munz.[2] From *A. Fendleri* it may be distinguished by the numerous, large, imbricated cauline leaves, the extremely long, slender pedicels and the usually single-stemmed habit. *A. Fend-*

[1] Fl. Calif. **2**: 70 (1936).
[2] Man. So. Calif. Bot. 204 (1935).

leri, in addition to having the leaf-blades covered with trichomes similar to those of *A. gracilipes*, has the leaf-margins ciliate. In the latter species the leaf-margins are never ciliate. *A. gracilipes* has more numerous flowers and the infructescence is more elongated than that of either *A. Fendleri* or *A. perennans*.

26. A. SPARSIFLORA Nuttall. Perennial; stems one to several from a simple or branching caudex, usually stout, simple or branched above, pubescent below with spreading or appressed trichomes (often glabrous in var. *atrorubens*) pubescent or glabrous above, (2.5–) 3–9 dm. high; basal leaves numerous, linear-oblanceolate to broader, usually acute, rarely obtuse, entire to irregularly dentate, harshly pubescent with coarse dendritic trichomes on both surfaces or the trichomes somewhat finer, 3–10 cm. long, 3–6 (–10) mm. wide; cauline leaves approximate, linear-lanceolate to broadly lanceolate, entire or the lower dentate, sagittate-auriculate, 2–8 cm. long, 3–6 (–10) mm. wide, usually obtuse, lower densely pubescent (glabrous or nearly so in var. *atrorubens*), upper pubescent or glabrous; sepals oblong, pubescent to sparsely so, 4–6 mm. long, 1.5–2 mm. wide, callose at base; petals pink to purple, spatulate (6–) 8–14 (–15) mm. long, 2–4 mm. wide; glandular tissue subtending all stamens, moderately developed; fruiting raceme elongated; pedicels divaricately ascending to spreading at right angles, often stout, pubescent with spreading or appressed trichomes or glabrous, 5–15 mm. long; siliques divaricately ascending to arcuately descending, slightly curved to strongly arcuate, glabrous, nerved below the middle, obtuse, 6–12 cm. long, 1.5–2 mm. wide; stigma sessile or nearly so; seeds orbicular, narrowly winged, uniseriate.

KEY TO THE VARIETIES OF A. SPARSIFLORA

a. Pedicels hirsute with spreading trichomes or glabrous, fruiting pedicels divaricately ascending to pendulous; lower stems hirsute with spreading trichomes or rarely glabrous ..... b.
b. Petals white, 6–8 mm. long; Montana to British Columbia and Yukon ..... 26f. Var. *columbiana*.
b. Petals pink to purple, 8–15 mm. long; plants south of British Columbia and Montana ..... c.
c. Upper leaves and stems glabrous to very sparsely hirsute ..... d.
d. Basal leaves entire, linear-oblanceolate; pedicels divaricately ascending, glabrate; stems usually branched above; Idaho and northern Utah to Oregon and northeastern California ..... 26a. Var. *typica*.
d. Basal leaves dentate, oblanceolate to broader; pedicels horizontal to somewhat ascending, hirsute or glabrous; stems rarely branched above ..... e.
e. Pedicels horizontal, usually hirsute; siliques strongly arcuate, widely spreading, nerved; widely dis-

tributed from northern California to Washington and eastward to the Rky. Mountains..26d. Var. *subvillosa*.

e. Pedicels ascending, glabrous; siliques only slightly arcuate, nearly nerveless; south central Washington.....26e. Var. *atrorubens*.

c. Upper leaves and stems hirsute; basal leaves linear-lanceolate, acute, coarsely pubescent; California. 26b. Var. *arcuata*.

a. Pedicels pubescent with closely appressed trichomes, fruiting pedicels usually widely pendulous; stems densely pubescent throughout with appressed trichomes; southern California to northern Baja California.....26c. Var. *californica*.

26a. Var. **typica.** Caudex often branched; stems fairly slender, simple or branched above, hirsute below, glabrate above; basal leaves long-petioled, entire; cauline leaves linear-oblong, obtuse, lower densely pubescent, upper glabrate; pedicels ascending, loosely pilose or rarely almost glabrous; siliques often only slightly arcuate but sometimes strongly so.—*A. sparsiflora* Nuttall in T. & G. Fl. N. Am. **1:** 81 (1838). *A. peramoena* Greene in Fedde, Repert. Nov. Sp. **5:** 242 (1908). *A. arcoidea* Nelson in Bot. Gaz. **53:** 220 (1912). *A. sparsiflora,* var. *peramoena* (Greene) Rollins in Res. Stud. State Coll. Wash. **4:** 25 (1936).—Idaho and northern Utah to California and Oregon. Map 13. Locality uncertain: R(ocky) Mts., *Nuttall s.n.* (Ph, isotype; photo of type in Gray Herb.). Idaho: St. Anthony, Fremont Co., May, 1919, *Quayle 19* (Cl, P, RM, US); Rexburg Butte, Madison Co., June, 1938, *Davis 308* (R); Little Lost River, Butte Co., May, 1938, *Davis 162* (R); Pocatello, Bannock Co., April, 1937, *Leiniger s.n.* (R); Picabo, Blaine Co., June, 1916, *Macbride & Payson 2979* (G, RM, US); New Plymouth, Payette Co., (formerly Canyon Co.), May, 1910, *Macbride 87* (RM, type; G, M, isotypes of *A. arcoidea*). Utah: Logan Canyon, Cache Co., May, 1932, *Maguire 3440* (UAC). Nevada: south of Secret, base of Ruby Range, Elko Co., June, 1937, *Nichols & Lund 99* (R); summit of Slumbering Hills, Humboldt Co., June, 1937, *Train 151* (G, R); Vya Spring, Vya, Washoe Co., May, 1939, *Train 2774* (NA, R); Mt. Rose, Washoe Co., July, 1913, *Heller 10943* (G, NY); Galena Creek, Washoe Co., Aug., 1906, *Kennedy 1248* (M); 2 miles west of Reno, April, 1910, *Heller 9993* (P, UC). California: near Lost Lake, Modoc Co., June, 1934, *J. T. Howell 12138* (G); Honey Lake, June, 1892, *Brandegee s.n.* (UC); Susanville, Lassen Co., June, 1897, *M. E. Jones s.n.* (P); Doyle Station, Lassen Co., May, 1911, *Eggleston 6727* (G). Oregon: Powder River, May, 1886, *Cusick 1348* (G); Forked Horn Butte, Deschutes Co., May, 1921, *Whited 22* (G, US); Camp Harney, Harney Co., May, 1885, *T. Howell 335* (G); Dry Creek, Crook Co., June, 1894, *Leiberg 340* (G, UC); Willow Creek, Malheur Co., May, 1900, *Cusick 2369* (US, type; G, NY, O, RM, WSC, isotypes of *A. peramoena*); Burns, Malheur Co.,

June, 1912, *Peck 2703* (G, W); Beulah, Malheur Co., June, 1896, *Leiberg 2310* (G, UC, US).

26b. Var. ARCUATA (Nuttall) Rollins. Usually woody at base; stem pubescent throughout, lower portion hirsute with large simple or branched trichomes; basal leaves linear-oblanceolate, acute, often borne on sterile shoots, coarsely pubescent; pedicels spreading, pubescent; siliques strongly arcuate.—Res. Stud. State Coll. Wash. **4:** 26 (1936). *Streptanthus arcuatus* Nuttall in T. & G., Fl. N. Am. **1:** 77 (1838). *Arabis arcuata* (Nuttall) Gray in Proc. Am. Acad. **6:** 187 (1864); Watson in King, Geol. Expl. Fortieth Parallel **5:** 18 (1871); Brewer & Watson, Bot. Calif. **1:** 23 (1876) in part; Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895) in part; Jepson, Fl. Calif. **2:** 69 (1936) in part, not *A. arcuata* Shuttlw. (1852). *A. Holboellii,* var. *arcuata* (Nuttall) Jepson, Man. Fl. Pl. Calif. 430 (1925). *A. maxima* Greene, Pittonia **4:** 192 (1900); Munz, Man. So. Calif. Bot. 205, fig. 102 (1935) in part. *A. arcuata,* var. *rubicundula* Jepson? Fl. Calif. **2:** 69 (1936).—MAP 13. CALIFORNIA: Sierra City, Sierra Co., June, 1938, *Constance 2302* (R); near Folsom, Sacramento Co., April, 1928, *Copeland 897* (P); Yosemite Valley, June, 1911, *Abrams 4483* (P); Mather, Tuolumne Co., May, 1931, *Keck 1124* (G, M); near Tollhouse, Fresno Co., May, 1938, *Constance 2213* (R); Hobo Hot Springs, Kern Co., April, 1938, *Constance & Mason 2120* (R); Mt. Day, Santa Clara Co., April, 1938, *Heller 8935* (G); near North Fork, Madera Co., May, 1938, *Eastwood & Howell 5420* (G, R); Big Tree Canyon, Tulare Co., July, 1891, *Coville & Funston 1350* (G); San Antonio Mts., May, 1918, *Johnston 1952* (G); Santa Barbara, *Nuttall s.n.* (G, isotype); Mt. Wilson, July, 1915, *Macbride & Payson 880* (G); 5 miles west of Julian, April, 1932, *Johansen & Ewan 7159* (P).

26c. Var. **californica,** var. nov. Herba perennis; caulibus robustis pubescentibus, pilis ramosis adpressis; petalis purpureis; pedicellis pubescentibus.

Stems coarse, pubescent throughout with fine dendritic trichomes; basal leaves large, coarsely toothed, densely pubescent with moderately fine dendritic trichomes; pedicels pubescent with appressed trichomes; petals deep purple.—*A. arcuata* sensu Brewer & Watson, Bot. Calif. **1:** 23 (1876) in part; Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895) in part; Jepson, Fl. Calif. **2:** 69 (1936) in part. *A. maxima* sensu Munz, Man. So. Calif. Bot. 205 (1935) in part.—Southern California and adjacent Baja California. MAP 14. CALIFORNIA: Mt. Lowe, near Dawn Station, Los Angeles Co., May, 1918, *Peirson 62* (Peirs); San Antonio Canyon Wash between Claremont and Upland, April, 1918, *Johnston 1973* (Cl, G, UC); 18 miles from Banning, Riverside Co., May, 1924, *Munz 8136* (G); Santa Rosa Mts., River-

side Co., May, 1937, *Munz 15085* (G); Warner's Hot Springs, San Diego Co., April, 1913, *Eastwood 2821* (G); near Campo, San Diego Co., May 24, 1903, *L. R. Abrams 3563* (G, TYPE; UC, isotype). MEXICO: 9 miles southeast of Tecate, Baja California, May, 1925, *Munz 9478* (P).

26d. Var. **subvillosa** (Watson) comb. nov. Stems hirsute below with large simple or branched trichomes, glabrous above; basal leaves dentate or very rarely entire, acute, harshly pubescent; pedicels spreading at right angles to rachis, hirsute; siliques arcuate.—*A. arcuata*, var. *subvillosa* Watson in Gray, Syn. Fl. N. Am. **1:** 164 (1895). *A. sparsiflora* sensu Howell, Fl. Northw. Am. **1:** 43 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 294 (1906); Rollins in Res. Stud. State Coll. Wash. **4:** 23 (1936). *A. campyloloba* Greene, Pittonia **4:** 192 (1900). *A. elegans* Nelson in Bot. Gaz. **30:** 192 (1900). *A. perelegans* Nelson in Coulter & Nelson, New Man. Bot. Rky. Mts. 228 (1909); Rydberg, Fl. Rky. Mts. 361 (1918); Tidestrom in Contrib. U. S. Nat. Herb. **25:** 244 (1925). *A. polytricha* Greene, Leaflets **2:** 72 (1910). *A. subserrata* Greene, Leaflets **2:** 79 (1910). *A. retrofracta* sensu Jepson, Fl. Calif. **2:** 67 (1936) in part.—Montana and Wyoming to California and Washington. MAP 14. MONTANA: Jack Creek, July, 1897, *Rydberg & Bessey 4222* (NY). WYOMING: Undine Falls, Yellowstone National Park, July, 1897, *A. & E. Nelson 5676* (G, RM), July 6, 1899, *A. & E. Nelson 6939*[1] (RM, TYPE of *A. elegans & A. perelegans*); 5 miles west of Beartooth Lake, Park Co., *Rollins & Muñoz 2856* (G, R). IDAHO: Edgemere, Bonner Co., June, 1923, *Large 54* (WSC); Albany Falls, Kootenai Co., May, 1923, *Sprague 399* (WSC); North Fork of the Salmon River, Lemhi Co., June, 1938, *Davis 428* (R); Shoup, 1919, *Kemp 60* (NY); Clearwater, *Spalding s.n.* (G); 6 miles south of Craigmont, Lewis Co., June, 1936, *Rollins 1118* (G, R); Martin, Blaine Co., July, 1916, *Macbride & Payson 3089* (G); Lake Waha, Nez Perce Co., June, 1896, *Heller & Heller 3173* (M, UC, US); near Sheep Creek, lower slopes of the Seven Devils Mts., Snake River Canyon, Idaho Co., May, 1936, *Moore 74* (G, R); Twin Springs, Elmore Co., May, 1937, *Buffat & Murdock s.n.* (G, R); Shoshone Falls, Lincoln Co., May, 1912, *Bennitt 57* (RM); Silver City, Owyhee Co., June, 1911, *Macbride 934* (RM). UTAH: 18 miles north of Vernal, Uintah Co., June, 1937, *Rollins 1760* (DS, G, R). NEVADA: San Juan Creek Canyon, Nye Co., June, 1937, *Goodner & Henning 395* (R); head of Summit Lake Creek, Humboldt Co., June, 1939, *Train 3040* (NA); Hunter Creek Canyon, Washoe Co., July, 1913, *Kennedy 3039* (G); Reno, June, 1897,

[1] No. 5680 was published as type, but the same number was cited as type of *A. densicaulis*. This number was found marked type in the Rocky Mountain Herbarium.

M. E. Jones s.n. (UAC). California: dry hills near Yreka, Siskiyou Co., May, 1908, *Butler 723* (ND, type; P, UC, isotypes of *A. polytricha*); Salmon River Canyon, Siskiyou Co., July, 1937, *Howell 13569* (G, R); Hornbrook, April, 1913, *L. E. Smith 104* (G); Igerna-Weed, June, 1905, *Heller 8083* (G); near Yreka, April & May, 1876, *Greene 695* (ND, type of *A. campyloloba;* photo in Gray Herb.); Mt. Shasta, June, 1939, *Cooke 13563* (G, R); Devils Backbone, Humboldt Co., July, 1935, *Tracy 14391* (UC); Red Clover Valley, July, 1907, *Heller & Kennedy 8713* (G). Oregon: Ice Lake Trail, Wallowa Mts., June, 1936, *Eastwood & Howell 3321* (R); head of Horse Creek, Wallowa Co., June, 1897, *Sheldon 8356* (M, RM); Pine Creek near Snake River, May, 1901, *Cusick 2518* (G, M, O, RM, UC, US); Owyhee, Mathew Divide, June, 1896, *Leiberg 2206* (G); Service Creek, Wheeler Co., May, 1925, *Henderson 5061* (G); near Lakeview, June, 1928, *Constance* (Henderson 9527) (O); Gearhart Mt., June, 1928, *Constance* (Henderson 9528) (O, WSC); Klamath Falls, Klamath Co., May, 1928, *Applegate 3506* (G, UC); rocky south slope of Siskiyou Mts., 3 miles north of Oregon-California boundary, Jackson Co., June, 1940, *Beetle & Constance 2621* (R). Washington: Bead Lakes, Pend Oreille Co., May, 1923, *Sprague 400* (WSC); Spokane, May, 1898, *Piper 2821* (G); Malden-Pine City, May, 1936, *Rollins & Constance 1093* (DS, G, R); Rock Lake, May, 1936, *Rollins & Constance 1100* (G, R, WSC); east of Coulee Dam, Grant Co., April, 1935, *Rollins 860* (G, R, RM, UC, US, WSC); Kamiak Butte, Whitman Co., June, 1936, *Constance & Clements 1800* (G, R); Pullman, Whitman Co., May 20, 1894, *Piper 1812* (G, type); above Anatone, Asotin Co., June, 1937, *Constance et al. 1875* (G, R); west of Ventura, Okanogan Co., May, 1936, *Edwards 237* (G, R); 10 miles east of Davenport, Lincoln Co., June, 1940, *Constance & Beetle 2748* (G); Ellensburg, Kittitas Co., April, 1897, *Whited 312* (US, type; WSC, isotype of *A. subserrata*); Rattlesnake Mts., Yakima Co., 1902, *Cotton 562* (G); Klickitat River, May, 1894, *Suksdorf s.n.* (G, M, WSC).

26c. Var. atrorubens (Greene) Rollins. Stems usually single, simple, glabrous to sparsely pubescent at the base; basal leaves spatulate to widely oblanceolate, irregularly dentate, thinly pubescent with dendritic trichomes; cauline leaves glabrous or the lower sparsely pubescent, somewhat dentate, the upper entire; pedicels divaricately ascending, glabrous to sparsely pilose; petals deep purple; siliques divaricately ascending to more widely spreading, nerveless.—Res. Stud. State Coll. Wash. **4:** 26 (1936). *A. atrorubens* Greene in Erythea **1:** 223 (1893); Watson in Gray, Syn. Fl. N. Am. **1:** 162 (1895); Howell, Fl. Northw. Am. **1:** 43 (1897); Piper in Contrib. U. S. Nat. Herb.

11: 294 (1906). *A. atriflora* Suksdorf in Deutsch. Bot. Monatsschr. **15:** 211 (1897.—South central Washington. Map 13. Washington: Rattlesnake Hills, Ellensburg, Kittitas Co., May, 1932, *Thompson 8254* (G); near Virden, Kittitas Co., May, 1935, *Thompson 11469* (G, T, UW); Darling Mts., Yakima Co., June, 1899, *Flett 1137* (WSC); Yakima Indian Reservation, April, 1932, *Heidenreich 68* (WSC); high prairie near Goldendale, June, 1926, *Suksdorf 12024* (R, WSC); western Klickitat Co., May, 1892, *Suksdorf 2105* (G, UC, US, WSC, isotypes).

26f. Var. **columbiana** (Macoun) comb. nov. Stems one to several, sparsely hirsute below, glabrous above; petals white, 6–8 mm. long; pedicels hirsute with spreading trichomes; siliques arcuate.—*A. columbiana* Macoun, Cat. Canad. Pl. **2:** 304 (1890).—Montana, British Columbia and Yukon. Montana: Rockwall Basin, 12 miles northwest of Wilsall, Park Co., July, 1921, *Suksdorf 362* (R, WSC). British Columbia: Yale, May 17, 1889, *Macoun 1677* (Can.); Fraser River Canyon, May, 1938, *J. W. & E. M. Thompson 19* (G); Vancouver Island, May 9, 1875, *Macoun s.n.* (Can). Yukon: Atlin, July, 1914, *Eastwood 638a* (G).

Arabis sparsiflora is a complex species occupying a wide geographic area and many different habitats. An attempt to organize the leading variants of the species inevitably led to the recognition of several varieties. These have been called species by some botanists, but they certainly do not parallel the other species of the genus as defined in the present work. Each variety is recognizable if carefully observed and its geographic area taken into consideration. However, there is no sharp morphological distinction which may be used as a basis for their being placed into entities of a higher order.

I have examined a photograph of the type of *A. sparsiflora* and studied an isotype at the Philadelphia Academy of Sciences. Although only the upper part (about one half) of the plants are represented in each case, the pubescence of the cauline leaves and spreading trichomes on the stem as well as the form and position of the siliques are distinctive and give clues as to their identity. These plants are matched by specimens from Idaho, Oregon and Nevada which I formerly called *A. sparsiflora*, var. *peramoena*. Thus a slight rearrangement of my former[1] interpretation of the varieties of *A. sparsiflora* is necessary. Those plants treated before as typical *A. sparsiflora* are actually var.

[1] Res. Stud. State Coll. Wash. **4**: 23–27 (1936).

subvillosa. A type for var. *subvillosa* was not designated by Watson or by Robinson who revised Watson's manuscript of *Arabis* before it was actually published in the Synoptical Flora. I have arbitrarily selected Piper's no. 1812 from Pullman, Washington, as type. The specimen answers the description of var. *subvillosa* and was undoubtedly one of those upon which the variety was based.

Variety *arcuata* and var. *californica* are very similar except for a few minor characters. The former has a very coarse, dense pubescence, and the trichomes on the pedicels and lower stems are spreading. The basal leaves are nearly linear and very often entire. In var. *californica* the pubescence is finer and appressed throughout. The basal leaves are oblanceolate to broader and usually dentate. Var. *arcuata* seems to be more or less confined to the mountains, whereas var. *californica* is usually at the base of mountain-ranges or on lower slopes nearer the desert. I have not seen the type of *A. arcuata,* var. *rubicundula* Jepson, but Heller's specimen no. 8935 from Mt. Day, its type-locality, is var. *arcuata*. Assuming the two plants to be the same, I am hesitatingly referring var. *rubicundula* to the older var. *arcuata*.

Greene in Erythea, l. c., described *A. atrorubens* attributing it to "Suksdorf in herb." Ordinarily the authorship of this epithet would be given as Suksdorf ex Greene. However, Suksdorf writing four years after the original publication disclaimed the name *atrorubens* and proposed the new *atriflora*. Since Suksdorf's action was positive, it seems wise to consider Greene as sole author of the species. With this interpretation, the specimen in Greene's Herbarium must be designated type, not the specimen at Washington State College, as I have previously indicated.

It is difficult to determine which of Macoun's specimens is the actual type of var. *columbiana*. He says the plant is "quite common on the lower slopes of the mountains bordering the Thompson and Fraser rivers from Spence's Bridge to Yale, B. C. First detected May 19, 1875". The only specimen sent from the National Herbarium of Canada answering the description of var. *columbiana* and nearly agreeing with the date of the presumed type-specimen is the one from Vancouver Island

cited above. This obviously is not the type nor is Macoun's no. 1677 from Yale, B. C. The latter specimen, however, undoubtedly represents the entity Macoun had in mind, therefore I am using it temporarily as a point of reference for the variety.

27. A. Hoffmannii (Munz) Rollins. Perennial, often coarse; caudex scaly, usually invested in old leaf-bases, woody; stems one to several, branched above, glabrous or very sparsely pubescent below, 5–7 dm. high; basal leaves numerous, crowded, linear-lanceolate to slightly broader, sinuate-dentate, obtuse, glabrous or nearly so above, pubescent with dendritic trichomes below, coriaceous, 5–10 cm. long, 6–10 mm. wide, mid-rib wide and prominent; petiole widely winged to base; cauline leaves sessile, crowded, linear-oblong, obtuse, auriculate and somewhat clasping, green and glabrous above, pubescent below, 3–6 cm. long, 4–6 mm. wide; sepals oblong, obtuse, green, glabrous to very sparsely pubescent, 4–5 mm. long; petals linear-oblong, slightly narrowed toward base, white, 8–10 mm. long; fruiting raceme greatly elongated; pedicels divaricately ascending, glabrous, 1–4 cm. long; siliques divaricate, straight or usually becoming slightly arcuate, glabrous, thick and coriaceous, nerveless, obtuse, 6–10 cm. long, 2–3.5 mm. wide; style nearly obsolete or short and stout; seeds orbicular, narrowly winged, about 1 mm. broad, biseriate.—Madroño **3:** 360 (1936). *A. maxima* Greene, var. *Hoffmannii* Munz in Bull. So. Calif. Acad. Sci. **31:** 63 (1932).—Santa Cruz Island, California: without definite locality, April, 1888, *T. S. Brandegee s.n.* (UC); ledges in sea cliffs, east of Dick's Harbor, Feb., 1932, *R. Hoffmann 653* (P, type), May, 1932, *R. Hoffmann s.n.* (P).

This species is remarkable for its greatly elongated pedicels, leathery nerveless siliques and very thick basal leaves. The species is related to *A. sparsiflora*, var. *arcuata*, but seems amply distinct on the basis of a number of characters. *A. Hoffmannii*, so far as known, is completely insular.

28. A. Breweri Watson. Caespitose perennial; stems several to numerous from a much-branched, woody caudex, simple, densely hirsute below with simple or rarely forked, spreading trichomes, often glabrous above, 6–20 cm. high; basal leaves broadly spatulate, entire to remotely few-toothed, obtuse, short-petioled, pubescent on both surfaces with usually three-forked hairs, 1–3 cm. long, 4–6 mm. wide, rarely larger; cauline leaves sessile, auriculate, oblong to oblong-lanceolate, pubescent, 1–2 (–3) cm. long, 4–6 (–10) mm. wide; sepals oblong, obtuse, pubescent, often purple-margined, or -tipped, non-saccate, 4–5 mm. long, 1–2 mm. wide; petals spatulate, reddish-purple to

pink, 7–10 mm. long, 3–4 mm. wide, tapering to a very narrow claw; glandular tissue on each side of single stamens and beneath paired stamens, nearly continuous; pedicels pubescent to rarely glabrous, 3–15 mm. long; siliques divaricate, arcuate to nearly straight, 3–7 cm. long, about 2 mm. wide, 1-nerved on the lower third of the valves; stigma sessile; seeds orbicular, narrowly winged, 1 mm. or slightly broader, uniseriate.

Key to the Varieties of A. Breweri

a. Pedicels 5–15 mm. long, hirsute or rarely glabrous; siliques 4–7 cm. long. . . . b.
  b. Petals 6–9 mm. long; cauline leaves usually less than 2 cm. long; pedicels 5–9 mm. long.....28a. Var. *typica*.
  b. Petals 10–13 mm. long; cauline leaves 2–4 cm. long; pedicels 10–15 mm. long.....28b. Var. *Austinae*.
a. Pedicels 3–4 mm. long, glabrous; siliques 2–3 cm. long 28c. Var. *pecuniaria*.

28a. Var. **typica.** *A. Breweri* Watson in Proc. Am. Acad. **11:** 123 (1875); Brewer and Watson, Bot. Calif. **1:** 33 (1876); Greene, Fl. Francis. 254 (1891); Watson in Gray, Syn. Fl. N. Am. **1:** 165 (1895); Howell, Fl. Northw. Am. **1:** 44 (1897); Jepson, Man. Fl. Pl. Calif. 431 (1925) and Fl. Calif. **2:** 65 (1936); Rollins in Res. Stud. State Coll. Wash. **4:** 22 (1936). *A. epilobioides* Greene in Fedde, Rep. Nov. Spec. **5:** 242 (1908). *A. rostellata* Greene, Leaflets **2:** 71 (1910). *A. Breweri* Wats., var. *figularis* Jepson, Fl. Calif. **2:** 65 (1936).—California and southern Oregon. Map 15. California: between Big Flat and Caribou Gulch, Siskiyou Co., *J. T. Howell 13568* (G, R); near Yreka, Siskiyou Co., April, 1934, *Eastwood & Howell 1762* (G, Peirs, R); north of Cabin Creek, Trinity Co., Aug., 1935, *Tracy 14529* (R, UC); Klamath River, Siskiyou Co., May, 1910, *Butler 1379* (M, P, RM, UC, US); Plumas County, 1880, *Austin s.n.* (G); Marysville Buttes, April, 1893, *Blankinship s.n.* (G); South Butte, Sutter Co., May, 1936, *J. & N. Ewan 9648* (R); Black Butte, Colusa Co., June, 1884, *Rattan 2* (G); Mt. Sanhedrin, Lake Co., July, 1902, *Heller s.n.* (US, type; G, M, Ph, isotypes of *A. epilobioides*); Elk Ridge, Mendocino Co., 1867, *Bolander 6561* (G, UC, US); Mt. Hood, Sonoma Co., March, 1902, *Heller & Brown 5190* (G, M, P, Ph, US); Mt. Diablo, Contra Costa Co., 1860–62, *Brewer 1086* (G, type; M, UC, WSC, isotypes); April, 1938, *Constance & Morrison 2192* (R); Mt. Hamilton, Santa Clara Co., May, 1907, *Heller 8617* (G, M, Ph, US); The Pinnacles, San Benito Co., March, 1930, *Mason 5524* (R), May, 1937, *J. T. Howell 12955* (G, R); Pico Blanco, Monterey Co., May-June, 1901, *Davy 7330* (UC); Tassajara, Monterey Co., June, 1901, *Dudley s.n.* (NY, US). Oregon: near Medford, Jackson Co., April, 1934, *Thompson 10319* (G, P, RM, T, US,

UW); Siskiyou Summit, Jackson Co., June, 1929, *Kildale 8314* (OS); Mt. Grayback, Josephine Co., June, 1904, *C. V. Piper 6156* (US, TYPE; G, W, isotypes of *A. rostellata*).

28b. Var. **Austinae** (Greene), comb. nov. Basal leaves entire to repand, 3–6 cm. long, 7–14 mm. broad, pubescent with large, spreading, dendritic trichomes; cauline leaves ample, 2–4 cm. long, 5–10 mm. broad, pubescent to nearly glabrous; sepals sparsely pubescent, purple, outer saccate, 5–7 mm. long; petals purple, spatulate, 10–13 mm. long, 3–4 mm. broad; pedicels 1–1.5 cm. long; siliques 5–7 cm. long, about 2 mm. broad.—*A. Austinae* Greene in Fedde, Rep. Nov. Spec. **5:** 242 (1908).—MAP 15. CALIFORNIA: Little Chico Canyon, Butte Co., March & April, 1896, *Mrs. R. M. Austin s.n.* (ND, TYPE); Little Chico Creek, March & May, 1896, *Mrs. R. M. Austin 868* (M); canyon of Chico Creek, below Ten Mile House, March, 1920, *Heller 13359* (M); rocks, Little Chico, Feb., 1897, *Mrs. C. C. Bruce 1945* (P).

28c. Var. **pecuniaria,** var. nov. Herba perennis; caulibus tenuibus 1–2 dm. altis; petalis 6–8 mm. longis; siliquis divaricatis 2–3 cm. longis, ca. 2 mm. latis; pedicellis glabris 3–4 mm. longis.—MAP 15. CALIFORNIA: rocky ledge, Dollar Lake, San Bernardino Mts., San Bernardino Co., August 24, 1922, *P. A. Munz 6238* (G, TYPE; P, Peirs, isotypes).

Plants from the northern portion of the range of *Arabis Breweri* are often taller, with straighter and more erect siliques, than those from nearer the type-station. These plants often have a perplexing mixture of the supposedly distinctive characters of both *A. Breweri* and *A. sparsiflora,* suggesting a possible hybrid origin. Plants of this sort were defined as var. *figularis* by Jepson, but I have been unable to discover characters which would consistently separate them from var. *typica. A. Breweri* is most closely related to *A. sparsiflora,* var. *arcuata,* with which it has many characteristics in common. For those who would consider *A. Lyallii* to be a variety of *A. Drummondi,* it would be necessary in order to be consistent, to place *A. Breweri* in a varietal category under *A. sparsiflora.*

Variety *Austinae* has larger leaves and flowers than var. *typica,* but the dimensions of the siliques and total height of the plants are similar. The very ample cauline and long basal leaves impart a distinctive growth-habit to var. *Austinae* which makes it easily recognized, even though the main points of its morphology are in agreement with the typical variety. Var. *pecuniaria* has cer-

tain traits in common with *A. Lemmoni* and may well be a remnant from a former series which linked the latter species with *A. Breweri.* Var. *pecuniaria* is isolated from typical *A. Breweri* and this isolation must have taken place very early because there is no evidence of intergrading characters between the two. That the variety should be associated with *A. Breweri,* rather than *A. Lemmoni,* there is little doubt.

29. A. Cusickii Watson. Perennial, caespitose; stems usually several, simple or rarely branched, erect to somewhat decumbent, hirsute below with large, spreading, simple trichomes, sparingly hirsute above to glabrous, 6–20 cm. high; basal leaves tufted, numerous, linear, acute, hirsute and somewhat ciliate, 1–3 cm. long, 2–3 mm. broad; cauline leaves linear to linear-lanceolate, sessile, not auriculate, 1–3 cm. long, 2–4 mm. broad; sepals oblong, hirsute, scarious-margined, non-saccate, 3.5–5 mm. long; petals spatulate, white to rose-colored, 6–10 mm. long, 2–3 mm. broad; glandular tissue weakly developed, continuous beneath all stamens; pedicels ascending, stout, glabrous to rarely sparsely hirsute, 5–15 mm. long; siliques arcuate-ascending, glabrous, nerved near the base, 4–8 cm. long, 2–3 mm. wide; stigma sessile; seeds orbicular, narrowly winged, 1–2 mm. broad, uniseriate.—In Proc. Am. Acad. **17:** 363 (1882) and in Gray, Syn. Fl. N. Am. **1:** 167 (1895); Howell, Fl. Northw. Am. **1:** 44 (1897); Piper in Contrib. U. S. Nat. Herb. **11:** 295 (1906); Piper & Beattie, Fl. Southeastern Wash. Adj. Idaho 116 (1914); Rollins in Res. Stud. State Coll. Wash. **4:** 20, fig. 6 (1936); St. John, Fl. Southeastern Wash. Adj. Idaho 164 (1937). —Idaho, Oregon and Washington. Map 8. Idaho: Salmon, Lemhi Co., June, 1920, *E. B. & L. B. Payson 1832* (Cl, G); hills near Challis, Custer Co., April, 1915, *Work 516* (FS); Garden Creek, Custer Co., April, 1915, *Work 532* (FS); Sawyer Canyon, Lewis Co., June, 1936, *Rollins 1121* (G, R); Middle Fork of Weiser River, Weiser National Forest, May, 1923, *Lommasson 158* (FS); near Joseph, Idaho Co., May, 1939, *J. H. Christ 10205* (Herb. J. H. Christ). Oregon: Union County, 1879, *Cusick 727* (G, type); 20 miles south of Ukiah, Umatilla Co., June, 1916, *Eggleston 12715* (US); near Rhea Creek, Morrow Co., May, 1894, *Leiberg 59* (G, O, UC, US); near Prairie City, Grant Co., April, 1925, *Henderson 5062* (G, M, O, US); near Maupin, May, 1928, *Thompson 4079* (T, US); Enterprise-Joseph, Wallowa Co., May, 1923, *Sherwood 20* (W). Washington: near Spangle, Spokane Co., April, 1916, *Suksdorf 8512* (G, NY, UC, US, WSC), May, 1916, *Suksdorf 8647* (G, UC, US, WSC); near Rock Lake, Whitman Co., May, 1936, *Rollins & Constance 1098, 1101, 1104* (G, R, WSC); near Pine City, Whitman Co., May, 1936, *Rollins*

& Constance 1091 (G, NY, R, WSC), May, 1898, *Piper 2828 & 2829* (G, WSC); Cleman Mt., June, 1892, *Henderson 2388* (G, UW); Ellensburg, Kittitas Co., May, 1897, *Piper 2711* (G, WSC); Johnson's Canyon, Yakima region, July, 1883, *Brandegee 624* (G, UC); Grande Ronde River, Asotin Co., May, 1922, *St. John & Brown 4198* (WSC).

This species is very distinctive and is easily separated from other members of the genus. At one point (near Pine City, Washington) in its range, there is apparently some natural crossing with *Arabis sparsiflora,* var. *subvillosa.* Piper collected specimens in the area which exhibit several-branched trichomes, hirsute pedicels and broader basal leaves than are usually found in *A. Cusickii.* These specimens are intermediate between the latter species and *A. sparsiflora,* var. *subvillosa.* Since *A. Cusickii* shows no such variations toward var. *subvillosa* in other parts of its range and since the departures from the normal toward *A. sparsiflora,* var. *subvillosa* take place in an area where both species abound, it is logical to assume that some natural hybridization has occurred. The hybrids, if indeed they are hybrids, are much closer to *A. Cusickii* than to *A. sparsiflora,* var. *subvillosa* and are provisionally placed with the former species.

Plants from the Salmon River Basin of eastern Idaho are not quite typical, in that they have but one or two stems and lack the strongly developed caudex usually found in the species. Also, the pubescence is less conspicuous, but these plants are not otherwise distinctive and seemingly do not represent a separate variety.

(*To be continued*)

A HYBRID CORNUS FROM CAPE BRETON.—

× CORNUS **acadiensis,** hybr. nov. (*C. alternifolia* × *C. stolonifera*) frutex adscendens, ramibus brunneo-purpureis valde divergentibus, medulla grisea; foliis oppositis pseudoverticillatis ovatis vel ellipticis breviter acuminatis, petiolis gracilibus 1–1.5 cm. longis; cymis 2.5–4 cm. diametro; fructibus lividis vel caeruleis.—NOVA SCOTIA: thicket along cold brook at head of Baddeck Bay, Baddeck, Victoria County, August 30, 1920, *Fernald & Long,* no. 22,092 (distrib. as *A. Amomum*), TYPE in Herb. Gray.

× *Cornus acadiensis* has the leaves crowded in subverticillate platforms as in *C. alternifolia* but opposite and with outline nearer that of *C. stolonifera*. Its horizontal branching suggests the former; the compact cyme and fleshy drupes suggest *C. stolonifera* but their color is that of *C. alternifolia*. So far as we yet know *C. Amomum* does not occur east of southwestern Maine;[1] and the eastern limit of *C. obliqua*, often confused with it, is in southeastern Maine or adjacent New Brunswick.

In Cape Breton both *Cornus alternifolia* and *C. stolonifera*, the probable parents of × *C. acadiensis*, are common.—M. L. Fernald.

[1] The citation in Gray's Man., ed. 7, of *C. Amomum* from Newfoundland was based on an old misidentification.

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